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This vast pile of steel and terra-cotta, now being built opposite the general Post Office, New York, will cover a plot 155 feet by 200 feet. Its topmost point will be 775 feet above the sidewalk.

THE TALLEST OF TALL BUILDINGS.—[See page 119.]

SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately and in simple terms, the world's progress in scientific knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fascination of science.

The Coroner on the Bridgeport Railroad Wreck

AS the result of his investigation of the recent wreck of an express train at Bridgeport, the coroner finds the New Haven Railroad guilty of "criminal negligence" in providing an unsuitable cross-over between the express and local tracks at the point where the disaster occurred. Although we agree with this finding so far as it attributes the wreck largely to the existence of a short cross-over, an opinion which is entirely in accord with our editorial on this subject in our issue of July 22nd, it is pushing the matter too far to designate the practice of the company as criminal.

Criminal negligence can be charged against a company only when it neglects to follow provisions for safe operation which have been established by law, or when it falls below the practice which has come to be regarded among the railroads as sufficient for safe operation. Judged by either of these tests, the New Haven cannot be held blameworthy. The use of short cross-overs between express and local tracks, or in locations where express trains running at full speed have to be switched from one track to another, is unfortunately very general in railroad practice. A few of the best roads, it is true, are alive to the danger; and, as we pointed out in the article referred to, one at least of them is revising its tracks by eliminating short cross-overs on main four-track roads where fast express trains may have occasion to cross from one track to another, but these are the exceptions and not the rule.

On the other point raised by the coroner, that it is inexpedient to use short cross-overs on lines over which express trains run, the coroner is entirely correct. The danger of a wreck through failure of the human element is so imminent, that we think the subject demands the immediate attention of the Interstate Commerce Commission, and the passage of a law requiring that such cross-overs be made of a proper length and the curvature of the turn-outs be made so easy that expresses can take them at high speed without danger of derailment. Although the cost of making these changes would be considerable, it would be well repaid by the greater safety which would be secured. Certainly, in cases like the Bridgeport wreck, where the cost of damages will prove to be enormous, the investment would prove to be good economy.

Solving Labor Questions in the Laboratory

AMONG the many methods proposed for the solution of difficulties between the employer and the workman, surely the most original is that suggested by Dr. A. Imbert, who, in a recent paper published in the *Revue Générale des Sciences*, proposes to apply laboratory methods to the solution of the wage problem. The author believes that physiology can furnish us with some precise information on the question of the ratio equivalence between work and pay.

Proceeding on the proposition that, in the work of a human or animal machine, the energy expended is produced by an increase in food above the amount which the organism requires when at rest, he makes the statement that the proper remuneration for work can be exactly determined, and this for the reason that it should correspond exactly to the cost of the extra food which made the work necessary.

The author considers the case of a postman who travels daily 35 kilometers on a bicycle in a level country, and who kept a record of the quantity and quality of the food which he consumed during a fortnight, the calorific value of which per day was calculated to be 3,200 calories. The day's work was estimated to be 140,000 kilogram-meters, corresponding to 330 calories of heat. Assuming a value of one-third for the efficiency of the human motor, Dr. Imbert determined that the postman's daily work required the combustion of an amount of food capable of furnishing 990 calories—an estimate which agrees very closely with one based on numerous physiological experiments showing that the human organism at rest requires daily on an average a quantity of food capable of furnishing about 2,300 calories. Now the difference between that and the 3,200 calories representing the value of his daily food as recorded by the postman gives a difference of 900 calories, which agrees fairly well with the 990 calories obtained by the first method of calculation. The mean equivalent may be taken as 945 calories.

The postman found that the cost of his food was 85 centimes a day, and from this it follows that the cost of his work was 25 centimes a day, instead of the four francs which he actually receives. It is evident that his pay should be based on something more than the monetary equivalent of the work done; the most selfish employer would concede that the pay should cover at least the 2,300 calories of food required by the man at rest, in addition to the 945 expended in work. Furthermore, he needs in addition to food, shelter and clothing, so that he should receive an additional allowance to pay for food, rent and clothing, items which are inseparable from any estimate of wages, even when they are considered exclusively as remuneration for work done. The pay should provide for the support of the workman's family. Therefore, physiologically considered, the system of payment based on the monetary equivalent of the increase of food required is certainly inadequate, and the pay should be based upon an intelligent consideration of the general circumstances of the workman's life and surroundings and his reasonable expectation of comfort, recreation, family life and provision for old age.

A more direct application of laboratory methods was that made in the south of France, where hundreds of women are employed with pruning shears in cutting up long American vine shoots into cuttings suitable for planting. It is a mechanical operation, capable of exact measurements. By applying to the shears a simple dynamometer in the shape of a rubber bulb, Dr. Imbert measured the work done, by means of the travel of the fingers and the pressure exerted, the latter being recorded on a moving strip of paper. The cuttings are classed as large or small, according as their diameter is greater or less than six millimeters, and the pay is 60 centimes per thousand for the large cuttings and 50 centimes for the small ones. The women asserted that the difference of ten centimes was not sufficient, and they obtained an increase of pay.

From the paper tracings, Dr. Imbert found that for each centime of pay the worker exerted a total effort of 110 kilogrammes in cutting the small stems at 50 centimes per thousand, and a total effort of 266 kilogrammes per centime in cutting the large stems at 60 centimes per thousand. It was evident from these figures that the pay was not proportional to the work, and the experiments furnished an incontestable proof of the justice of the women's demands. For if fifty centimes was paid for the small cuttings, the pay for the large ones should have been 140 centimes instead of 60 per thousand.

Dr. Imbert claims that his system can be applied to a wide range of manual work, where the multiplicity of mechanical actions would seem to present an obstacle to experimental study of this kind. For instance, he used it successfully to determine the actual work accomplished in moving bags and bales with a hand-truck. The correctness of his conclusions would seem to be borne out by a comparison of the same work when it was done first with a truck and alternately then with a wheelbarrow, the wheelbarrow proving, of course, to be the more fatiguing medium. The article of Dr. Imbert which is published in full in the current issue of the SUPPLEMENT, will be found to repay a careful study.

Amazing Progress in Aviation

FOR the third time within the past three months a French naval lieutenant, who learned to fly only the first of the year, has won a long-distance cross-country race and demonstrated his prowess in airmanship. We refer to Lieut. Conneau, who, flying under the name of André Beaumont, has met with wonderful success in aviation. In the Paris-Madrid, Paris-Rome, the European circuit, and, lastly, the *London Daily Mail's* Circuit of Great Britain, Lieut. Conneau, flying a Blériot monoplane, has been among the leaders. In all but the first-mentioned race he has succeeded in finishing the winner.

All of these races have been from 900 to more than 1,000 miles in length, but the English circuit was the most difficult on account of the rule requiring the aviator to finish the race with the same aeroplane and motor with which he started and without the replacement of any of the essential parts. Three French monoplanes, piloted by two Frenchmen (Lieut. Conneau and Jules Vedrines) and one Englishman (Mr. Valentine) led the race from the start. Valentine was forced out after a gallant struggle and after he had completed half of the circuit, on account of a broken propeller; but his two competitors, because of their experience and training, finished the race without mishap and in record time. When the rules of this race were formulated it was believed that ten days would not be too long a time to allow for the completion of the circuit, yet despite the enforced rest made necessary by the rules, Lieut. Conneau and M. Vedrines completed the course in 34 1-2 hours and 35 3-4 hours, respectively, and finished a week ahead of the time limit which had been set for the completion of the race. The actual time in flight of the French lieutenant was 22 hours and 28 minutes, corresponding to an average speed of 45 miles an hour, while Vedrines required an hour and 16 minutes longer, which reduced his speed to 42.8 miles an hour. The speed averaged by the winner in this race was about the same as the speed he made in the European circuit. The remarkable feature of the race was the fact that it was completed without mishap or breakage of the machines, and distances as great as from New York to Montreal were covered at a 60-mile clip. The present race was for the aeroplane very similar to the "sealed bonnet" contests that were in vogue a few years ago for automobiles. It is interesting to note that a prize of $30,000 for the first aviator who should fly from New York to St. Louis—a distance of about 1,060 miles—even with a time limit of 100 hours, did not interest any aviators, American or foreign, when it was offered a year ago. It is doubtful even now whether this prize would attract any foreign aviator should it be put up for competition again. What is needed in America is a prize of $50,000 to $75,000 for a circuit race of 1,200 to 1,500 miles. If the Aero Club of America could organize such a race, it would show itself worthy of being the representative organization, and would encourage a development of aviation in a way that has never yet been done in this country.

Next to endurance in cross-country flying, the endurance of man and machine in a single flight is one of the most interesting questions. At the end of last year, Henry Farman attempted to remain aloft in continuous flight for a period of 12 hours. He actually succeeded in flying continuously for 8 hours and 12 minutes. Since then he has always been eager to increase his record to the half-day point. On July 21st, M. Loriden, in one of his machines, managed to fly continuously for 11¾ hours, during which time he covered a distance of 469 miles. It is claimed that he alighted on account of fatigue and not because his fuel was used up. On July 26th, at Mineola, St. Croix Johnstone, in a Moisant monoplane, made 39 circuits of a 5-mile course, covering 195 miles in 4 hours, 1 minute, 54 3-5 seconds, in an effort to break M. Loriden's record. He was obliged to descend on account of motor trouble, but he raised Parmalee's endurance record, made last January at Los Angeles, by 22 odd minutes.

The above achievements show the wonderful strides that are being made week by week in aviation and lead us to believe that within a very few years we shall have trans-continental and trans-Atlantic aeroplanes flying at faster speeds than the modern express trains.

Even at the present time express-train speed has been greatly exceeded. In the English circuit Lieut. Conneau flew the 343 miles from London to Edinburgh at sixty miles an hour and beat by a whole hour the fast "Flying Scotsman" express, while in the Paris-Madrid race Vedrines covered the 280 miles between Paris and Angouleme at the rate of 70.

Eighty Years of Locomotive Practice in England

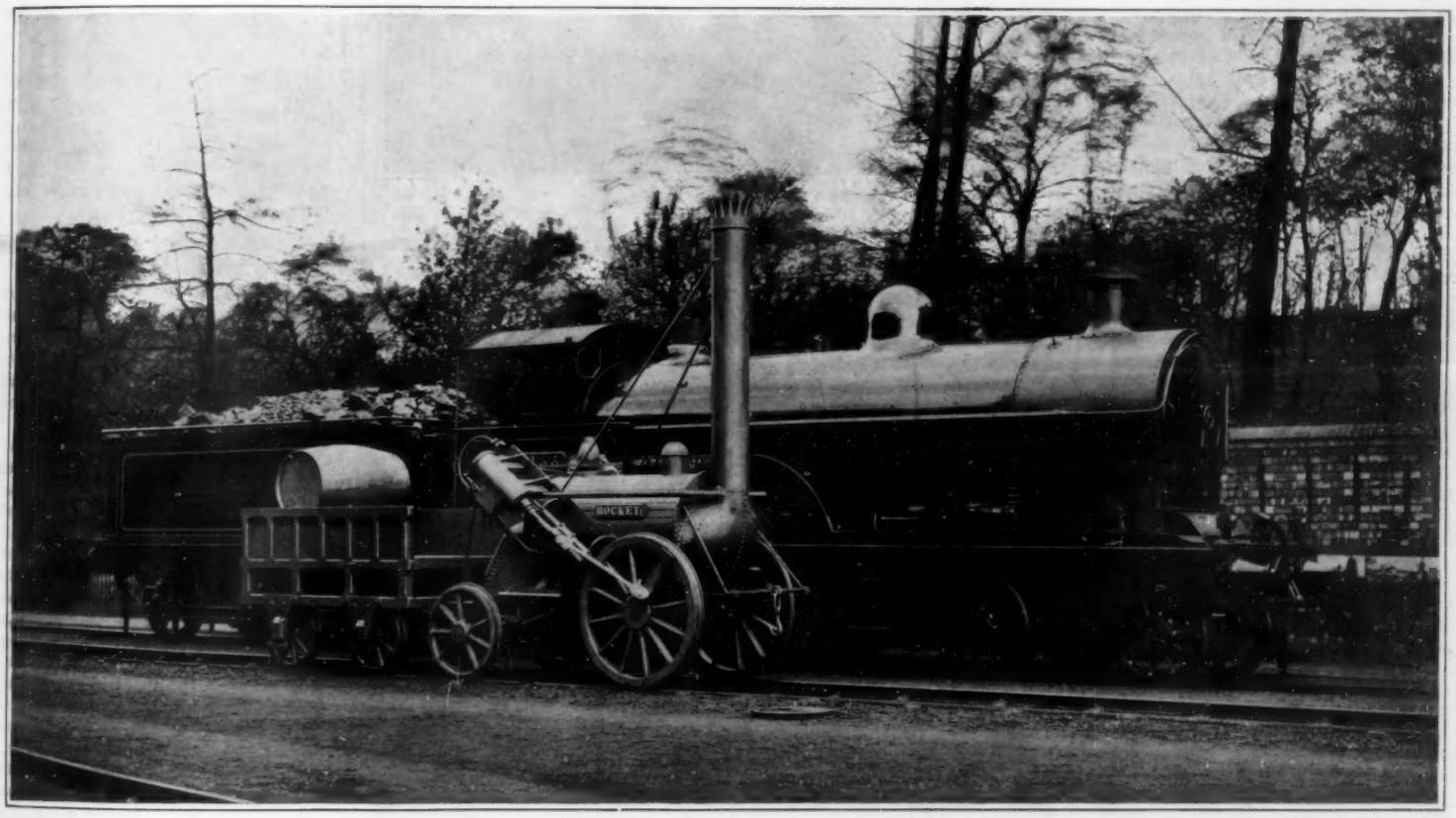
How the Old "Rocket" Compares with a Modern Engine

IN the accompanying illustration an interesting impression is conveyed of the development of the railway locomotive in Great Britain during a period of eighty years. Stephenson's famous "Rocket" is here shown in comparison with the latest type of London and Northwestern Railway passenger express traffic locomotive, "W. C. Brocklehurst, No. 2155," of the new "George the Fifth" class, and their juxtaposition affords a comprehensive idea of the remarkable strides that have been made in railway engineering upon British railways. The "Rocket" was built in 1829, and took part in the famous contest at Rainhill, when the directors of the Liverpool and Manchester Railway, now forming part of the London and Northwestern system, offered a prize of $2,500 for the purpose of deciding the question of the adaptability of steam locomotives for working railways. Five engines were entered in that classic competition, from which the "Rocket," as is well known, emerged victorious.

It is interesting to compare the weight and speed of the train in this competition, which may be regarded as the standard for those early days, with those of modern times. It was stipulated in the 1829 competition that the successful engine, if it weighed 6 tons, should be capable of drawing after it, on a level plane, a train of the gross weight of 20 tons, including tender and water tank, at the rate of 10 miles an hour, while the steam pressure in the boiler was not to exceed 50 pounds per square inch. In the actual trial the "Rocket" attained an average speed of about 19 miles per hour while hauling a train weighing 13 tons.

Stephenson's engine had a cylindrical boiler measuring 6 feet in length by 3 feet in diameter, with flat ends, having 25 copper tubes of 3 inches diameter. The firebox was 2 feet wide and 3 feet high. The cylinders, two in number, were 8 inches in diameter, and had a stroke of 16½ inches, while the diameter of the driving wheel was 56½ inches. The engine exerted about 20 horse-power, and weighed 9,296 pounds, while the tender weighed about 7,168 pounds. The latest London and Northwestern engine standing alongside is one of the latest types of express engines used in this company's express traffic. The two inside cylinders are each 20½ inches in diameter, and have a stroke of 26 inches, with a boiler pressure of 176 pounds per square inch, or three and a half times that allowed in the "Rocket." The boiler is 62 inches in diameter, with a barrel 141¾ inches long, fitted with a steam superheating arrangement by means of which the temperature of the steam is raised to 650 deg. F. before being used in the cylinders. The firebox is 7 feet 4 inches long by 4 feet 1 inch wide outside the casing. The coupled driving wheels are 81 inches in diameter, while the weight of the engine in working order is 133,064 pounds, and that of the tender 86,920 pounds, giving a total weight of 219,984 pounds. It is fitted with apparatus for picking up water from troughs while traveling at full speed, and has a tank capacity of 3,000 gallons, while it carries 7 tons of coal.

In order to test the power and capability of this type of engine, the first locomotive built, the "George the Fifth," made an experimental run between Crewe and Euston, 158 miles, with a train composed of a dynamometer car and 13 8-wheeled corridor coaches weighing 357½ tons, and with engine and tender weighing 454¼ tons. On the outward journey one stop was made at Rugby, the average speed between these points being 54 miles per hour, the highest speed recorded being 68 miles per hour. Between Rugby and Euston the average speed was 58¼ miles per hour, with a maximum of 73 miles per hour. The return journey from Euston to Crewe was made without a stop, which distance was covered from station to station in 2 hours 36½ minutes, giving an average speed of 60½ miles per hour, with a maximum speed of 78½ miles per hour. These speeds and weights compared with what the "Rocket" achieved illustrate strikingly the enormous progress made in one branch of railway engineering, and show the great facilities placed before the public for rapid transit from one point to another in these days, as compared with the condition in the early days of British railways.



Stephenson's "Rocket," and the latest type of English locomotive (George the Fifth type).

A STUDY IN LOCOMOTIVE EVOLUTION

The Comets

DR. WILLIAM R. BROOKS, director of the Smith Observatory, and professor of astronomy at Hobart College, Geneva, N. Y., discovered another comet on the night of July 20th. Its position was right ascension 22 hours 13 minutes 40 seconds; declination north 20 degrees 57 minutes. The comet is in the constellation Pegasus, and is moving slowly in a northwesterly direction.

While not at present visible to the naked eye, it is a fairly bright telescopic comet, and its movements will be observed with interest. This is the twenty-sixth comet discovered by Prof. Brooks—a larger number than any other living astronomer has found.

The Kiess Comet.

A comet was discovered by Kiess at the Lick Observatory on July 6th in R. A. 4 h. 51 m. 51.8 s.; Dec. north 35 deg. 15 m.

An observation of this comet was obtained by Dr. William R. Brooks at the Smith Observatory, Geneva, N. Y., on the morning of July 13th, in R. A. 4 h. 40 m.; Dec. north 34 deg. 10 m., which shows the motion of the comet to be southwest. It is in the constellation Auriga, and on the last named date about 11 degrees south of Capella.

It is now a bright telescopic comet and has a visible tail.

Artificial Measles in Monkeys

MANY attempts have been made to cultivate the specific organism related to the cause of measles in the blood of such animals as are commonly used for experiments on serums and toxins, etc., but without success. About seven years ago an English experimenter tried in various ways to infect chimpanzees by injection of blood taken from a measles patient but got only negative results.

Within the last year Dr. John F. Anderson, Director of the Hygienic Laboratory, and Dr. Joseph Goldberger have carried on similar experiments with a number of rhesus monkeys. The blood used was drawn from measles patients. The monkeys showed rises in temperatures characteristic for this disease, and in a number of cases there were distinct eruptions on various parts of the skin. Two of the monkeys that showed distinct symptoms were held for the purpose of inoculating other monkeys, two new ones being inoculated from each. After a number of days, each of the monkeys showed definite reaction in temperature; one in each pair also showing an eruption of the skin. From these experiments it may be hoped that further research in the attempt to obtain anti-toxic sera for measles, or at any rate further light upon the nature of the disease, will be more profitable for treating the malady, than those of the past.

The "Electric Arc"

A Pioneer Electrically-propelled Ship

By the English Correspondent of the Scientific American

FOR some two or three years past there has been considerable academic discussion regarding the possibilities of propelling large vessels by an electrical system. Two Scottish electrical engineers, Messrs. Mavor and Coulson, of Glasgow, who have devoted considerable attention to this problem, have carried theory to a practical stage, a special vessel having been built by the Dumbarton shipbuilding firm of MacLaren Brothers, and equipped with the electric propulsion set which they have evolved for use with alternating current. Through the courtesy of the inventors we are enabled to describe the features and illustrate this interesting craft.

The vessel measures 50 feet between perpendiculars; has a beam of 12 feet; molded depth of 7 feet 4 inches; a maximum draft of 4½ feet, and is certified by the Board of Trade to carry fifty passengers. It has been christened appropriately the "Electric Arc."

The mechanical equipment is carried out on the lines set out by Mr. Mavor in his paper, read before the Institution of Engineers and Shipbuilders in Scotland in February, 1908, and before the Institution of Civil Engineers in December, 1909. It comprises a six-cylinder Wolseley gasoline motor developing 45 brake horse-power, driving an alternating current dynamo with its exciter, the propeller being coupled to an alternating current motor. The switch gear is operated from the deck, or from the engine room, as desired.

The inventors point out that although electric propulsion is not necessary or suitable for all vessels, yet in many cases it will form a convenient and economical addition to the power equipment of a ship. Hitherto electric transmission for marine propelling purposes has always been carried out upon the continuous current principle, but while this method is very convenient and suitable for small powers, its utilization offers serious difficulties in large installations. The inventors therefore maintain that alternating current motors alone are suited for the transmission of high powers at sea. They accordingly evolved their own lines upon which such should be applied, and the present large size model for actual practical experiments was constructed to demonstrate the possibilities and advantages of the system in regard to large vessels, and also to gain experience in details of application and handling of this equipment.

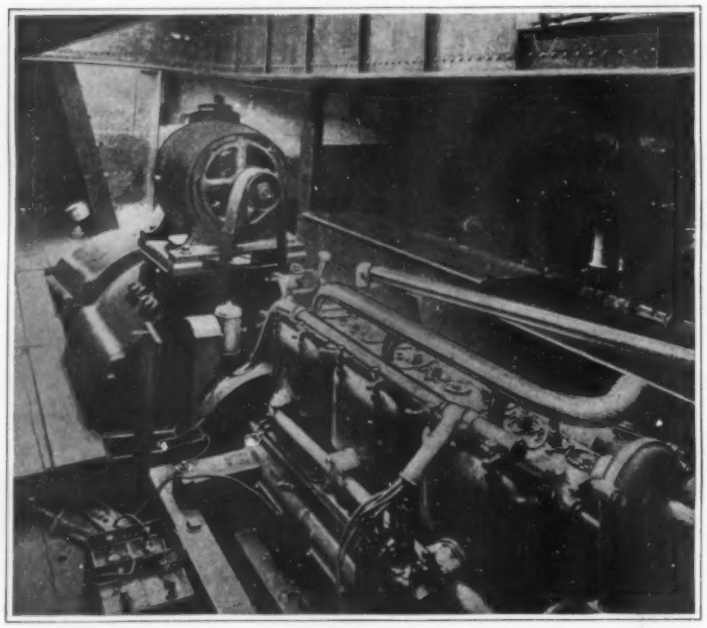
The motor has no brushes or slip-rings. It is of the type known as the "multiple wound machine," in which there are in the present instance two independent windings. The current used is alternating three-phase. The generator is designed to give two power-circuits to the motor, to represent the condition which would obtain more usually when larger powers were involved and where two or more generators would be in use for the full power.

The first combination of generator and motor windings gives full speed of 7.25 knots, and the second combination about two-thirds of full speed—about 5 knots. The power applied to the propeller is determined by the electric control, which in the present case is put in the hands of the navigator and operated from the bridge.

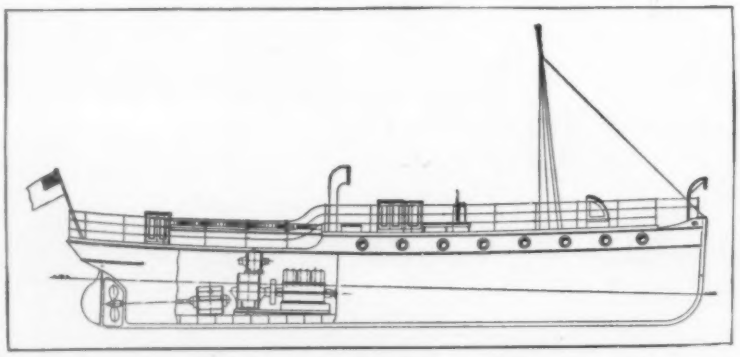
The first trials with the "Electric Arc" proved eminently successful. It was run over the measured mile in the Gareloch, the tests comprising the stopping, starting, speed-changing, reversing and maneuvering qualities of the vessel. The mean speed attained was 7.25 knots, with the propeller making 415 revolutions per minute. The current readings showed that about 25 brake horse-power was delivered to the propeller shaft at full speed, and that 35 brake horse-power was developed by the engine running rather below the rated speed.

The maneuvering capabilities of the boat were very strongly emphasized, the propeller being reversed from ahead to astern and *vice versa* time after time.

The reversing operations were equally striking, it being shown possible to throw the switch from "full speed ahead" to "full speed astern," or *vice versa*, without running any risk of damaging the machinery. Though such a sudden change would not be required in actual practice, it offered a severe test of the capabilities of the electrical system. The experiments are to be continued, and the success achieved so far has resulted in greater interest being centered in the possibility of adapting electrical propulsion to large vessels.



The engine and dynamo room of the "Electric Arc."



Elevation partially in section, showing general arrangement of the "Electric Arc."

The "Electric Arc" under way.

A BOAT PROPELLED BY ELECTRICITY

Fish Pastes Abroad

EXPERTS in the United States are giving careful study to the methods in vogue in certain fish factories in northern Europe, with a view to the economical preparation of products from fish that hitherto Americans have regarded as useless.

Among these is the preparation of fish-pastes from fish that have no commercial value either as fresh or salted food, but which, at the same time, possess a high nutritive value. It is said that the flesh of both the shark and the whale (which latter, however, cannot, of course, be properly classified as a fish) are largely utilized for the preparation of a fish-extract that resembles in some respects the popular extracts of beef, being at the same time far cheaper. All fishy flavor is eliminated by chemical processes, and the extract is valuable for the foundation of soups and in general cookery.

Whale meat is very nutritious, but its excessive amount of fat renders it unpalatable to most persons. So this fat is removed before the extract is boiled down to a syrupy consistence and sealed in jars.

In many of the fish factories of Norway a "fish-meal" is made that is eaten extensively by the nations of northern Europe. In these several ways fish which were formerly rejected as being unfit for food are being utilized to the advantage of many.

Trees and Men

IT has been calculated that a single tree is able through its leaves to purify the air from the carbonic acid arising from the perspiration of a considerable number of men, perhaps a dozen or even more.

The volume of carbonic acid exhaled by a human being in the course of twenty-four hours is put at about 160 gallons; but by Boussingault's estimate, a single square yard of leaf-surface, counting both the upper and the under sides of the leaves, can, under favorable circumstances, decompose at least a gallon of carbonic acid in a day. One hundred square yards of leaf-surface then would suffice to keep the air pure for one man, but the leaves of a tree of moderate size present a surface of many hundred square yards.

The Aviation Motor

Recent Developments in France

By Earle L. Ovington, Licensed Aviator

EMPLOYING the broadest possible classification, the science of aviation may be divided into two epochs—before man flew and afterward. The former might be called the Experimental Period and the latter the Practical Period. To be sure, at present there seems to be considerable discussion as to the exact line of demarkation separating these periods, but this resolves itself largely into a definition of the word "fly," as applied to the particular subject in hand. Lilienthal and other early experimenters with gliding machines undoubtedly imitated nature more closely than many later workers who used power-driven aeroplanes; but remarkable as were many of these early experiments, they did but pave the way for real man-flight, which may be considered to have been accomplished only when man left the ground with a power-driven sustaining surface, under more or less stable conditions. The object of the discussion which is raging so fiercely throughout the world of aviation at the present time is to ascertain who was the first to fly in a power-driven aeroplane, with the machine under the control of the operator, particularly as applied to lateral stability.

Any one who has given the subject even casual examination cannot but be impressed by the remarkable similarity of some of the more advanced machines of the Experimental Period as compared with many of the successful fliers of the Practical Period. Indeed, this similarity is so marked that the enthusiast seeks further for the cause, and has not gone far before he realizes that the development of the light and efficient internal combustion motor has done more than anything else to lift aviation from the experimental stage to that of practical man-flight.

In the automobile field we find a parallel state of affairs. Clumsy self-propelled steam vehicles existed years before the brilliant inventions of De Dion and Daimler gave to the world the wonderfully light and comparatively simple prime mover which has made the automobile the universally successful vehicle it is to-day. It is the same with the aeroplane. Examine Langley's man-carrying machine, which unfortunately was never properly tested, and the large, ingeniously constructed aeroplane of Sir Hiram Maxim, not to mention other models of early experimenters, and one is impressed by the enormous handicap they labored under in not having a simple, light motor.

In the early development of the aviation motor, extreme lightness was the object sought for, and was at first obtained only at an entirely disproportionate sacrifice of efficiency and reliability. Fortunately for aviation, however, the development of a suitable motor did not have to start from the heavy, stationary gas engines, for at the dawn of the Practical Period in aviation the automobile engine had already reached a comparatively high state of perfection. Designers of aviation motors at first simply took the more advanced types of automobile motors, and, adhering to their general design, eliminated weight by reducing the

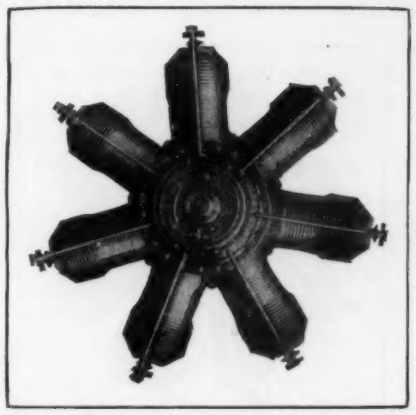


Fig. 1.—The new 70-horse-power Gnome motor.

factor of safety of each member to the lowest practical point, and by employing the very highest grade of material and workmanship. The Antoinette motor, which proved so successful in racing motor boats and the early aeroplanes, is a sample of this type. And it speaks well for Monsieur Levavasseur, the designer and constructor of this motor, that even to-day, in spite of the fact that the latest type of motor differs little from the earlier models, the Antoinette engine is considered in the foremost class among aviation motors.

At the present time, extreme lightness for a given output is as much sought for in aviation motors as it was in the first stages of development of the practical aeroplane. But this is due largely to the fact that an artificial state of affairs exists in the development of the aeroplane by the world's greatest designers and builders. During the Experimental Period of aviation, man was satisfied to progress slowly and along rational lines. Theory was far in advance of practice. During this period Langley, Lanchester and Maxim gave to the science of aviation their unparalleled researches, not to mention the works of less known writers. But from the moment man really flew, Practice vanquished Theory, and designers proceeded along almost entirely empirical lines to develop a flying machine for exhibition and racing purposes. From the opening of the Practical Period to the present time, designers have been too busy actually building machines to meet the comparatively enormous demand, to worry very much about the theoretical side of the subject. Very great progress has been made, to be sure, but it has been largely confined to making the machines stronger and faster, and in standardizing, to a certain extent, the several types.

The demand for a light aeroplane for exhibition purposes, and a fast one for racing, has forced the designers of aviation motors to tax their inventive capacities to the utmost in an effort to produce a motor of the greatest possible power for a given weight. And when it is considered that there now exists a motor which weighs only about three pounds per horse-power, which has run continuously over eight hours in actual flight, we can get an idea of the wonderful strides made in the development of the aviation engine.

Although to-day lightness and speed seem to be the greatest aims of the designer, the time is not far distant when extreme reliability and high efficiency will be the objects sought for. By its very nature an aeroplane remains in the air only so long as it is moving rapidly forward, and a properly working motor is necessary for this condition; hence reliability, without any question whatever, is the first essential in an aviation engine, assuming, of course, that the motor is light enough for the purpose. Duplicate power plants, or possibly a smaller power plant for emergency use, will do much to add to the security of aerial travel; but even under such circumstances the motive power should be as reliable as it is possible to make it. And as we understand more fully the design of the supporting surfaces in an aeroplane, and the engineers more fully appreciate the desirability of reducing head resistance to a minimum, great power in a light

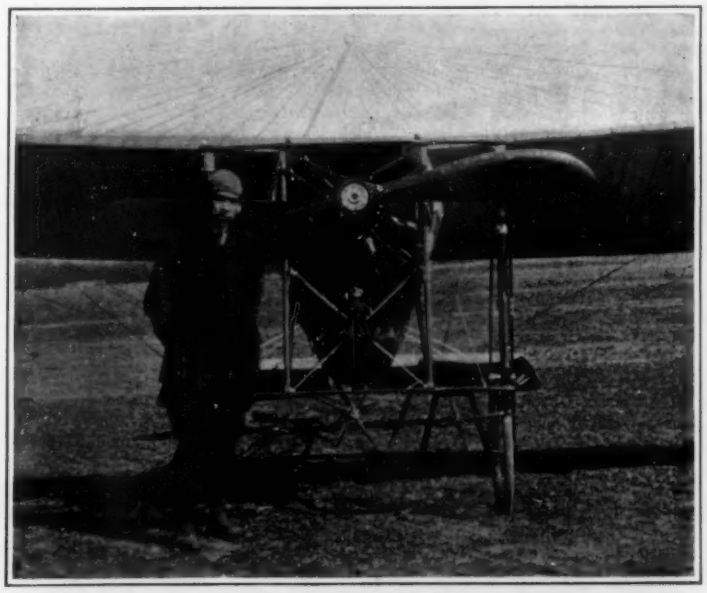


Fig. 2.—Bleriot 1911 model fitted with the 70-horse-power Gnome motor.

Fig. 4.—A "gun carriage" used for testing the Gnome motor.

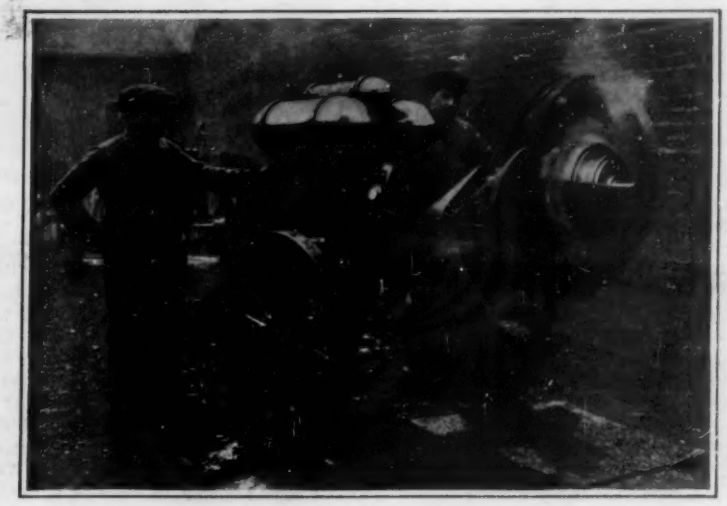


Fig. 5.—The 70-horse-power Gnome motor in action.

THE DEVELOPMENT OF THE AVIATION MOTOR

weight will become of less and less importance. The designer of the little Nieuport monoplane made giant strides in this direction when he produced a machine carefully calculated to reduce head resistance. This machine, although fitted with only a 30-horse-power motor, almost equaled the speed record made by Leblanc at Belmont Park with his fourteen-cylinder, 100-horse-power, Gnome-driven Blériot.

Birds soar for hours under propitious circumstances with practically no expenditure of energy, and even under very adverse conditions fly with an efficiency which should make the intelligent aeroplane designer drop from his self-erected pinnacle as "conqueror of the air," and realize how poor indeed, from the standpoint of the natural fliers, is his flying machine.

Aviation motors may be broadly divided into two general classes—reciprocating and rotary motors. In the former the cylinders and crank case remain stationary while the crank shaft rotates, and in the latter type the crank shaft is stationary while the crank case and cylinders revolve around it. All automobile engines, and most aero motors, are in the reciprocating class, while the Gnome is by far the most prominent engine in the rotary class.

It is interesting to note the various and often ingenious expedients adopted by the leading manufacturers to attain the same end, i. e., the production of a light motor. The designer of the Anzani reciprocating engine, who was one of the very first to devote his time to the production of a practical aviation motor, developed his product from the power plants he used on his motorcycle pacing machines. His first engine was a three-cylinder one, having the cylinders all in one plane and arranged radially around the crank case. By this arrangement he was able to use a crank case for three cylinders which was only slightly larger than that for one. With this motor, rated at 25 horse-power, Blériot first crossed the English Channel, and in spite of the remarkable strides which have been made in more powerful aero motors, this original type of Anzani, almost unchanged, is to-day one of the most reliable engines made, and is the one used by Blériot and other leading manufacturers in their aeroplanes made for school purposes. The writer, who obtained his French *brevet de pilote-aviateur* at Blériot's school at Pau, France, was surprised at the enormous amount of abuse these little motors stood without materially losing their power. Anzani's latest product is a six-cylinder, star-shaped motor of the same type, which somewhat resembles in appearance, when stationary, the rotating motor so much used in French aeroplanes.

The R. E. P. reciprocating engine, the product of Robert Esnault-Pelterie, is another motor of this class where the cylinders are arranged radially around a common crank case. The designer has carried this principle very much farther, however, than any one else, for the writer saw last February, at the factory near Paris, a new R. E. P. engine having no less than ten cylinders.

In the Antoinette engine the factor of safety has been reduced to a minimum, and made as uniform as possible for the component parts, by the use of the very highest class of material and workmanship. Every little detail has received the attention of its experienced designer, Monsieur Levavasseur, and most ingenious are some of the structural details. The flywheel, for instance, which ordinarily is by far the heaviest member of an engine, in the Antoinette is simply a steel rim connected to a central hub by a flange of very thin and flexible steel. When the motor is building up its speed, this flange is so flexible the whole flywheel seems "out of true," but at normal engine speeds centrifugal force is sufficiently strong to make the flywheel as rigid as if it were the usual heavy cast affair. In the Antoinette flywheel almost every ounce of weight is where its effect is greatest—in the periphery. Other equally novel artifices are employed in order to reduce weight.

Among American engines of the reciprocating class the Curtiss is probably the best known and most widely used. Curtiss, like the designer of the Antoinette, has carefully studied every part of his design and produced a motor remarkably light and efficient. It was with this motor, in his own aeroplane, that Curtiss won the first Gordon Bennett race at Rheims, France, in 1909, triumphing over the best European productions.

The question has yet to be definitely settled among designers of reciprocating engines as to whether cooling by air or water is the most desirable for aero engines. Of the engines mentioned, the Antoinette and Curtiss use water cooling, while the Anzani and R. E. P. depend upon air. It is perhaps significant to note, in this connection, that the Renault motor is air cooled, while the famous automobile engine, made by the same concern, is cooled by water circulation. Simplicity being such a desirable point where reliability is sought for, and reliability being such an essential in the aviation motor, the writer strongly favors the air-cooled motor, even for engines of the reciprocating class.

We now come to the consideration of what is undoubtedly the most interesting and promising type of internal combustion motor to-day—the rotary engine. The designers of this comparative newcomer made a giant stride into the unknown when they entirely

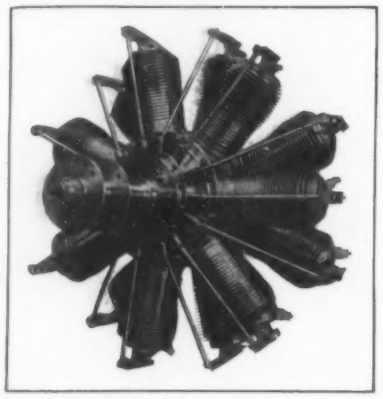


Fig. 6.—The 100-horse-power fourteen-cylinder Gnome, as used by Leblanc and Hamel in the recent International Cup race.

A 7-cylinder, 70-H. P. engine on a Nieuport monoplane won the race.

reversed the operation of the component parts of the gasoline engine. Incidentally, in doing so, they banished forever certain inherent difficulties found with motors of the reciprocating class.

In the ordinary reciprocating motor, the cylinders, whether air or water cooled, are stationary, as is the crank case, while the crank shaft revolves. In the rotary motor, the crank shaft is the stationary member, while the cylinders, arranged radially and air cooled, rotate with the crank case around it. As there is to-day only one representative of the rotary class, which has universally proved its right to be classed as unquestionably reliable, we will confine our remarks to that particular make—the wonderful Gnome rotary motor.

Fig. 1 is the very latest product of the Gnome factory—the new 70 horse-power. Fig. 2 shows the

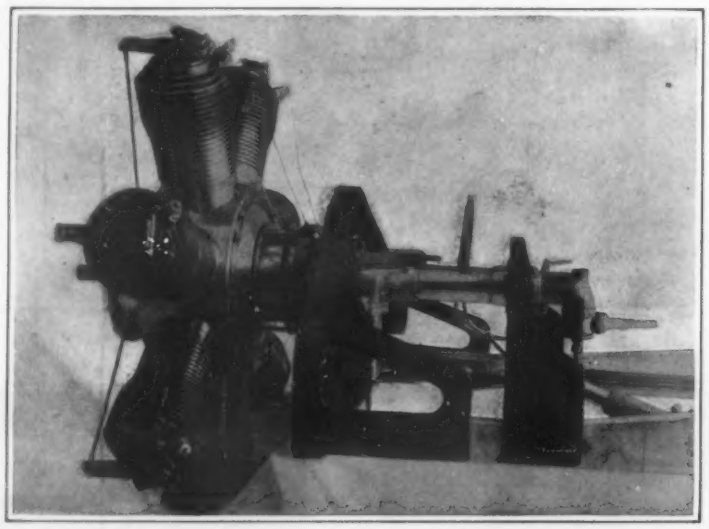


Fig. 3.—View of side and rear of the new 70-horse-power Gnome.

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writer's 1911 model Blériot, fitted with this motor, it being the first machine sent out from the Blériot factory employing the motor of 70 horse-power, and the first Blériot with the new "inverse curve" tail brought to America. Comparing the 50-horse-power and the 70-horse-power engines, the method of attaching the cylinders to the crank case has been greatly improved. In the case of the 50 horse-power it requires a mechanic of the highest order, who knows the Gnome motor thoroughly, to dismount and assemble it, but with the new 70 horse-power it is necessary only to unscrew a few nuts when the front half of the crank case may be removed, leaving the cylinders readily detachable. The method of clamping the cylinders, too, is far more secure than in the older model.

The writer spent a most interesting afternoon going over the Gnome factory, which is just outside of Paris, with Monsieur Seguin, the chief engineer. This factory is literally engaged in turning out steel shavings, for every part of the entire motor is turned from the solid metal. In the rough the cylinders are drop-forged nickel-steel bars; but when the lathes and boring tools have completed their work, they are engine cylinders with radiating fins as thin as paper and walls not much heavier. It is interesting to note, in speaking of the Gnome cylinder construction, that the receptacles into which the spark plugs screw are internally threaded steel tubes welded into the side of the cylinder head by a secret welding process, the arrangement being shown in Fig. 3. The crank shaft is hollow, and through it pass the gasoline vapor and oil for lubrication. The construction is indicated in Fig. 3, the carbureter being plainly visible at the end of the shaft, while the oil pipes enter the shaft from above as shown. Just to the left and below the oil pipes may be seen the pumps which force the fuel and oil under pressure to perform their duties.

The vapor from the carbureter, after passing into the crank case through the hollow crank shaft, is admitted to the combustion space in the head of the cylinders through automatic inlet valves which are balanced by counter weights to eliminate the action of centrifugal force. The wonderful ingenuity of construction of these valves, making them easily removable through the cylinder head without the necessity of taking down the engine, must be remarked upon.

The exhaust valves are of course mechanically operated, the construction being clearly evident by an examination of the illustration.

The magneto is behind the mounting framework in Fig. 3, while the segment bearing part of the distributer rotates, and from the segments wires lead to the spark plugs, as clearly indicated.

Fig. 4 shows one of the testing "gun carriages" in use at the Gnome works, with a motor in place. Fig. 5 gives an idea of the appearance of this wonderful motor in action, while Fig. 6 is a view of the 100-horse-power engine with fourteen cylinders. This is the motor used by Leblanc and Grahame-White when the latter won the Gordon Bennett race at Belmont Park last fall.

The writer has made a deep study of internal combustion motor design, and is firmly of the opinion that the rotary engine is the aviation motor of the future, not to say the present. The Gnome motor to-day holds practically all the world's speed records, which is remarkable when the handicap in favor of the reciprocating engine from the standpoint of time taken in development is considered.

In the case of the rotary motor, the cylinders and crank case serve as an efficient flywheel, thereby eliminating dead weight which is of no other use on the reciprocating engine. Vibration, due in the reciprocating engine to the unbalanced moving parts, is practically done away with in the rotary motor. With the rotary cylinders, water cooling, with its additional weight and complication, is not even thought of, for the rapid movement of the cylinders themselves through the cooling medium is all that can be desired. A closer examination of the two types emphasizes many other advantages of the rotary motor, such as a reduction in size and weight for a given power, reduction of the number of bearing surfaces, etc.

The principal disadvantage of the rotary motor at present is the fact that castor oil is the only lubricant which has been found so far to be satisfactory, and on account of the nature of the oil used, comparatively large quantities must be employed. Critics have even called it "the oil-cooled motor." Furthermore, the use of this oil in such large quantities (varying from one part of oil to three or four of gasoline) makes frequent cleaning necessary. In spite of this, however, the Gnome engine has forced its way to the front rank, against the adverse criticism and even abuse which has always stood in the path of true progress, until to-day it is the engine above all others where the greatest power and reliability are derived for the least weight. The idea of the writer in speaking so forcibly of the superiority of the Gnome motor is to awaken engine designers in America to the evident superiority of the rotating type over the reciprocating, with the hope that American manufacturers will attack the problem of rotary motor design, and, with their characteristic ingenuity and enterprise, produce an American aviation engine which will stand second to none. The rotary motor of the Gnome

type is the nearest approach yet made to the ideal internal combustion engine—the gas turbine—and as such demands recognition by every American manufacturer. Incidentally, the writer has heard on good authority that the Gnome company are experimenting with a two-cycle engine of the rotary type. Since the proper cooling and scavenging of the cylinder of this class of motor are the two hitherto almost insurmountable obstacles, it would seem the rotary principle is particularly adapted to the development of this class of engine.

The Tallest of Tall Buildings

WORK is now in progress at Broadway and Barclay Street on the foundations of one of those huge steel-and-concrete office buildings, which are such a characteristic feature of the modern architecture of New York city. The Woolworth building, as it will be called, will have a frontage of about 155 feet on Broadway, between Barclay Street and Park Place, and it will extend into the block for a depth of about 200 feet. Its most distinguishing characteristic, at least to the popular eye, will be its great height, for its crowning element, ball or lantern, or finial, or whatever it may be called, will stand exactly 775 feet above street level.

At the site there is the characteristic deep bed of quicksand, and through this the foundations are now being carried down everywhere to solid rock, which is about 110 feet below the sidewalk. Hence the structure, from lowest foundation to its topmost point, will have a total height of 885 feet.

The main building, which will cover the whole area except for a 35 by 96 foot interior rear court, will contain 31 stories, and above this there will rise from the center of the Broadway façade a great tower, 84 by 86 feet square, which will extend, with vertical walls, to the 50th floor, with an offset at the 42nd floor, where the dimensions are reduced to 69 by 71 feet, and at the 47th floor, where there is a further reduction to 59 by 61 feet. The height from the sidewalk to the 31st floor, which marks the top of the main roof, will be 400 feet. The tower extends another 270 feet, from the 31st to the 50th floor, making the height above sidewalk to this point 670 feet. Here it is surmounted by a pyramid which is 54 feet square at the base, in which are five additional floors and an observation gallery, the last-named being at an elevation of 730 feet above the sidewalk. There are two floors below street level, and the general height of each story throughout is 12½ feet. The Woolworth Building is designed in accordance with the Building Code of this city, which allows 150 pounds per square food load on the first and basement floors and 75 pounds per square foot on each of the other floors. When we remember that a uniform wind pressure of 30 pounds per square foot over the whole surface of the building has been provided for, it can be understood that the stresses from wind alone reach enormous figures. The maximum direct compression from wind pressure on one single column of the building reaches 2,500,000 pounds, to which must be added 200,000 pounds delivered from the portal bracing.

The steel framework alone will contain 20,000 tons of steel. Its various columns will be supported on 69 piers of partly reinforced concrete, which are now being sunk to solid rock at an average depth of 110 feet below street level. Except where conditions call for rectangular shapes, the caissons are cylindrical, and they vary from 8 feet 3 inches to 18 feet 9 inches in diameter. They are loaded to a maximum of 18 tons per square foot. Generally speaking, the axes of the columns stand in line with the axes of the caissons; but in some cases they are placed eccentrically, and their load is transferred to the center of the caisson by means of heavy steel girders acting as cantilevers. These girders are very massive and stiff, being as much as 2 inches in thickness in the web, and having an average depth of 8 feet, with a maximum weight of 60 tons.

From the 55th to the 50th floor, the inclined members of the pyramid take care of the wind stresses. From the 50th to the 47th floor, deep floor girders with solid gusset plates serve the same purpose. From the 42nd to the 28th floor, the exterior wall columns are braced against the wind by extra deep wall girders, and by knee braces, reaching well in to the center of each story. From the 28th floor to the street, every panel between the outside columns facing Broadway and the opposite face of the building is stiffened by a full-depth web portal with heavy flanges. Transversely to Broadway, the bracing is by means of single portals, reaching across the full width of the tower.

There are in the building 60 main columns of closed box section. The maximum load on a single column reaches the enormous figure of 4,750 tons, and this column measures at the base, 2 feet 6 inches by 3 feet 8 inches, the total cross section of metal being 650 square inches. The architect of the building, Mr. Cass Gilbert, and his consulting and designing engineer, Mr. Gunvald Aus, are to be congratulated on the design. The SCIENTIFIC AMERICAN has frequently suggested that for good architectural effect it would be advisable, in these tall buildings, to accentuate the vertical lines at the expense of the horizontal. Mr. Gilbert has done this to a marked degree, and in his treatment of the tower he has introduced those open-work pinnacles or "towerettes," if we may coin a word, which the medieval builders used to such happy effect in the towers of their Gothic cathedrals.

The exterior walls are to be built of granite up to the fifth floor, and above that of terra cotta. The building will be served by 26 elevators, all of which will be thoroughly fireproofed; also there will be four commodious fire-escape stairways, widely separated from one another, and each built in a fireproof shaft. The structural steel will have a coating of one inch of cement mortar; their interior spaces will be filled in solid with concrete or mortar, and the whole will be inclosed in a shell of terra cotta 3 inches thick. There will be no wood whatever nor any inflammable substance in the building. Doors, windows and trim will be of pressed steel, floors of mosaic, and exposed exterior windows will be glazed with wire clamps.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Our Merchant Marine.

To the Editor of the SCIENTIFIC AMERICAN:

The issue of the SCIENTIFIC AMERICAN for July 15th was very interesting. The suggestions for restoring the American merchant marine run on the old lines, viz., differential duties or subsidies. Free ships are anathema.

Mr. Sulzer believes that differential duties on goods brought in by American steamers will restore the American flag to the deep-sea trade. He bases it on the fact that up to 1828, differential duties freighted in American ships were in effect

The fact is ignored that, although after 1828 the differential duty law was no longer in effect, as stated by Mr. Sulzer, our shipping continued to grow until at the time the civil war broke out we were a close second to Great Britain in shipping.

Why we grew in shipping till we had almost overtaken Great Britain and were fast outstripping her is not touched upon; no mention is made of the fact that we had the natural resources in abundance, i. e., timber of the best quality that grew down to the edge of the ocean. This naturally stimulated a seafaring people to build ships. The ventures were successful; shipping grew; free from the building traditions of the old world, new types were, in the course of time, evolved, that were not alone marvels of beauty, but great deadweight carriers as well; and for speed they had no equals among the productions of European yards.

Is it any wonder, then, that shipping in the United States grew so fast, that the supremacy of Great Britain as a shipping nation was threatened.

In those days there was no cry that shipping was unprofitable; the Stars and Stripes were seen in every sea, and we traded every country on the globe. Then came the civil war and the transfer of our ships to foreign flags; later the introduction of the iron-built steam tramp, and gone was the occupation of the wooden sailer, and the grass grew in the shipyards of Massachusetts and Maine.

Yet to-day the United States makes more iron and steel than Great Britain and Germany together. On the authority of iron and steel manufacturers, we manufacture it cheaper than anywhere else in the world. We have shipyards that can turn out as good ships as can be turned out anywhere in the world. With all these advantages, we are told that we cannot build as cheaply as can builders abroad.

American capital is furnished to build steamers in foreign shipyards, and many of these steamers are built from plates exported from this country.

In spite of this, Mr. T. G. Roberts, naval constructor U. S. N., apparently believes that an adequate merchant marine can be built up only by discriminating duties and subsidies. In his mind the results of a free-ship bill would only result in "splendid imaginary shipping." The shipping owned by Americans is not at all imaginary; there are many millions of dollars invested in shipping running under foreign flags; application has been made to Congress for the privilege of placing some of it under the American flag, but permission is withheld. Why?

And yet, Mr. Roberts states in the heading of his article, "The Merchant Marine as an Auxiliary to the Navy," the navy would need some nine hundred merchant vessels to draw from in case of war.

Allow that our coast yards could turn out fifty 5,000-ton steamers annually, it would take something like eighteen years to build them, and it is not to be supposed that our navy will stand stationary during that period; neither does he take into account the annual growth of commerce and the consequent need of new tonnage annually.

Several fleets now operated under foreign flags are owned by Americans, and in case of war foreign governments could take them as auxiliaries to their navies. It seems but wisdom to allow such tonnage American registration. If Americans will not avail of the privilege, then it may become necessary to take further measures to insure American tonnage under the American flag.

The passage of such a measure might mean the avoidance of a great deal of trouble in the future. Even though foreign flags fly over American-owned tonnage, it may be expected that American owners will look to the United States Government for aid, should their investments be seriously threatened; and it would be no source of gratification to Americans in case of war, to find the tonnage for which we furnished the capital used in conjunction with a foreign navy to subjugate us.

Congress has just passed a reciprocity treaty with Canada covering farmers' produce. We can enter reciprocity with Great Britain in shipping by passing a free-ship bill. Great Britain now allows American-built ships British registration when owned by British citizens. Let Congress enact a law granting American registration to American-owned British-built ships for the Philippine and foreign trade only.

Chicago, Ill. CHARLES DEPSEL.

Observation of the Kiess Comet

To the Editor of the SCIENTIFIC AMERICAN:

The Kiess comet was observed here early on the morning of July 20th, 1911, by the writer, with a 3-inch refractor. As it is equivalent to about the seventh magnitude, and easily visible through a small telescope, it should be perceptible even in an opera glass. It is rather small, though bright, and resembles a nebula, and is moving in a southwestern direction. At about 2:15 A. M. on July 20th it was approximately 4 degrees west and a very little to the south of the star Iota Aurigae, which is of the third magnitude and not far from Capella, so can be easily located from this object. The position of the comet on July 12.8412 G. M. T. was R. A. 4 h. 41 m. 35.2 s.; Dec. + 34 deg. 19 min. 20 sec.

Berlamont, Mich. FREDERICK C. LEONARD.

Why Left-hand Plows are Used in the Middle West

To the Editor of the SCIENTIFIC AMERICAN:

In the issue of the SCIENTIFIC AMERICAN for June 17th, 1911, in "Notes for Inventors," I note the comment on the extensive use of left-hand plows in southern Ohio, Indiana and Illinois. The explanation of such use is found in the fact that these localities were largely settled by people from Southeastern Pennsylvania, Maryland and southward, in which latter localities it was and is, to a large extent, yet customary to drive two or even four horses with a single line, the line being attached to the left-hand or "near" horse only, the "off" horse being guided by a "jockey stick," one end of which is tied to his bit and the other end to the "near" horse's hame or collar. In plowing with such an arrangement it would obviously be necessary to place the guiding or "near" horse in the furrow, which would necessitate the use of a left-hand plow.

The custom of single line driving has probably been largely abandoned in the above first-mentioned localities, owing to the extra effort and time required to train the horses, but the use of left-hand plows has continued, and probably will continue indefinitely, due to the fact that each generation learns to plow with the tools of its elders, and having once learned with a left-hand plow, the change to right-hand is not easy. E. W. HEISS.

Patent Office, Washington, D. C.

Abstracts from Current Periodicals

Phases of Science as Other Editors See Them

Fig. 1.—Greek undergarments.

Fig. 2.—The Egyptian sarcophagus produced hygienic results although designed for other purposes.

Fig. 3.—Babylonian drain which shows that ages ago the proper disposal of sewage was attacked hygienically.

Historical and Popular Exhibits at the International Hygienic Exposition in Dresden

TWO of the most interesting departments of the International Hygienic Exposition which is being held in Dresden are the historical and popular sections. In the historical section the history of hygiene is illustrated by numerous models and pictures, as well as by other means, and similar methods are employed in the popular section, the purpose of which is to give the average visitor a clear and non-technical presentation of the progress of hygiene and to impart some practical information concerning the laws of health.

Illustrations and descriptions of some of these exhibits are here reproduced from a recent issue of the *Illustrite Zeitung*, which is filled with interesting matter relating to the exposition, to which it is entirely devoted.

In the historical section the visitor is enabled to review the progress of hygiene from the infancy of civilization to the present day. The record is very incomplete, and is made up of fragments laboriously unearthed by the archæologist, for the writers of history and the makers of monuments deal almost exclusively with wars and kings, and devote little attention to the life of the people.

We know from excavations that the Celts and Germans, before they came into contact with Roman civilization, lived in caves and cellars, and the human bones found in these underground dwellings show that gout and rheumatism were very common, as might be expected. The inhabitants of the upper Nile region were also grievously afflicted by gout.

These northern tribes, after the primitive age of furs and skins, wore close-fitting breeches and sleeved shirts of thick wool, in striking contrast to the light and flowing garments of the Romans and Greeks (Fig. 1), and in entire accordance with the difference in climate.

The disposal of the dead is a subject of great hygienic importance, and is well illustrated in the historical section. Although cremation, embalming and the sealing of corpses in tight oaken coffins, stone sarcophagi (Fig. 2) and vaults, were probably not adopted for hygienic reasons, they produced hygienic results, especially in view of the widely prevalent custom of keeping the remains of deceased members of the family very near or even in the house.

Among other customs of hygienic value but non-hygienic origin may be mentioned bathing, which in many lands was regarded as a religious, rather than a hygienic duty.

Again, the ritual requirement of perfect health in animals which were offered in sacrifice (and which, by the way, often constituted the only animal food used) was firmly established among the Babylonians, Egyptians, Jews and Greeks, ages before there was any official inspection of slaughter houses.

Hygienic motives, however, were consciously followed by the Greeks, Romans and other ancient peoples in house building, paving, draining, sewerage, water supply, the construction of private and public baths, and in many other things. An ancient Babylonian drain is illustrated in Fig. 3, while Fig. 4 shows a model of the outlet sluices of the Alban Lake.

Two institutions of great hygienic value originated in Mesopotamia and were brought to Europe by the Jews—the weekly day of rest and the isolation of diseased persons. In the Middle Ages the precepts of Leviticus were developed into a system of sanitary regulations which, in a desperate warfare waged for

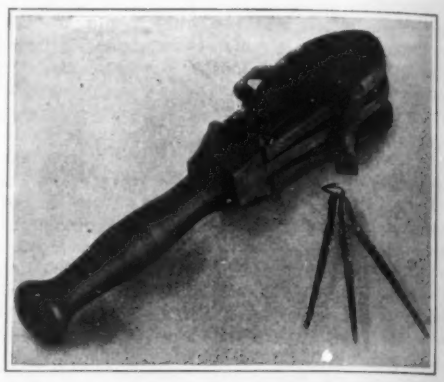


Fig. 5.—A leper's rattle.

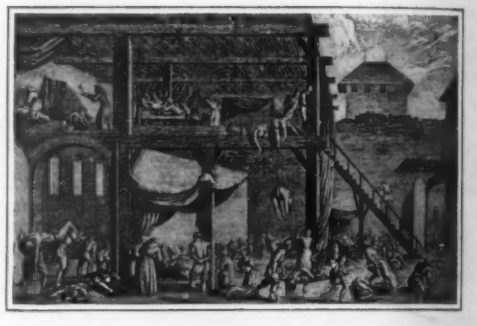


Fig. 6.—A Vienna pest house in 1679.
From a contemporary engraving.

Fig. 7.—Bathing customs in the fourteenth century.

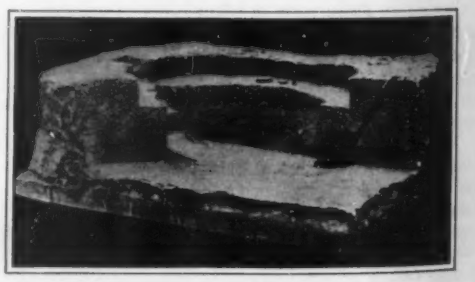


Fig. 8.—Chimney of earth dwelling of the stone age.

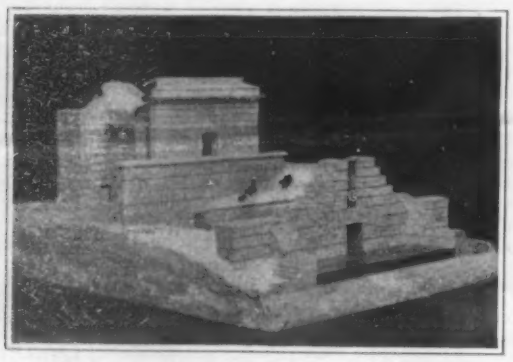


Fig. 4.—Model of outlet of the Alban Lake.

Fig. 9.—Medieval and modern shoes, clogs and goloshes.

Illustrations by courtesy of *Illustrirte Zeitung*.

EXHIBITS AT THE INTERNATIONAL HYGIENIC EXPOSITION, DRESDEN

centuries, finally defeated the dreaded Asiatic invader, leprosy. Fig. 5 shows a rattle used by the leper to give warning of his presence.

The epidemics of the plague, and especially the black death (1348-1350) led to the establishment of municipal and state quarantine and other preventive measures which are still employed. The Romans had small military hospitals, but general hospitals, leproseries and pest-houses (Fig. 6) originated in the Middle Ages.

The characteristic German fondness for bathing was freely indulged even in the Dark Ages, when every village had its Turkish bath. The fashion prevailed, not without abuses (Fig. 7) throughout the Middle Ages, but waned in the seventeenth century in the general depression caused by the Thirty Years' War. In the eighteenth century the "return to nature" which followed the French Revolution led to a resumption of the practice of bathing in streams, which had previously been prohibited as unseemly. At that time hygiene was earnestly studied in France, the war against the corset was inaugurated, and, in 1802, a general council of health was founded. During the same period Jenner, in England, introduced vaccination, which in a few decades put an end to the frightful epidemics of smallpox which had long ravaged Europe. The epidemic of cholera in England in 1831 contributed greatly to the promotion of cleanliness and of hygiene in general.

These are a few of the subjects that are copiously illustrated by the historical exhibits of the exposition, which also show the hygienic progress that has gradually been made in house building, cooking, heating, lighting and clothing, in the installation of prisons, barracks and abattoirs, in travel by sea and land, etc. Fig. 8 shows a model of a chimney such as was used in underground dwellings after the need of such a device had at last become apparent, and Fig. 9 exhibits a diversified assortment of medieval and modern footgear.

Few people appreciate the great boon of health until it is lost or seriously impaired. This fatalistic indifference is explained by the general ignorance of hygienic laws. Great advances have been made in physiology in the last few decades, and the cause and the means of prevention, if not of cure, of nearly every disease are known by physicians, but very little of this knowledge has reached the mass of the people. The popular section of the Hygienic Exposition is designed to impart this knowledge, in such a form that it can be understood at a glance. The attentive and intelligent visitor will leave this section impressed with the wonderful complexity of the body and the value of good health, and filled with the resolve to preserve this precious gift with jealous care. The

Fig. 10.—A very bad well.

Fig. 11.—A bad well.

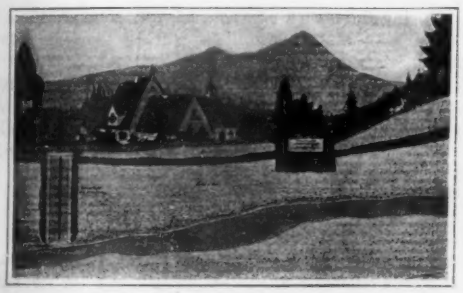


Fig. 12.—A poor well.

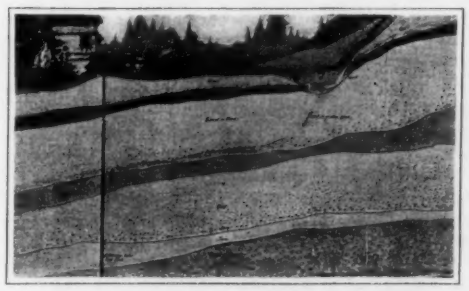


Fig. 13.—A good well.

Fig. 14.—Types of dwellings; from left to right, ancient Jewish, Amazon Indian, Saxon farmhouse, Canadian Indian, Herero.

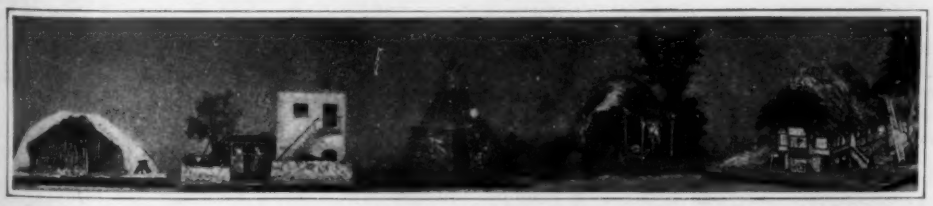


Fig. 15.—Types of dwellings; from left to right, Eskimo, Italian, old German hut, earth dwelling, Schwarzwald farmhouse.

Fig. 16.—Hygienic bed.

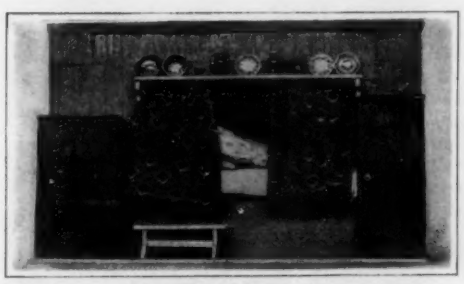


Fig. 17.—Alcove bed.

No. 1.—98.6 No. 2.—97.7 No. 3.—94.1 No. 4.—92.3 No. 5.—89.6 No. 6.—86.0 No. 7.—79.7 No. 8.—77.9

Fig. 21.—Heating and cooling effect of various hats, in the sun, with an external temperature of 96.8 deg. F. The temperature inside each hat is indicated by the figures printed under it.

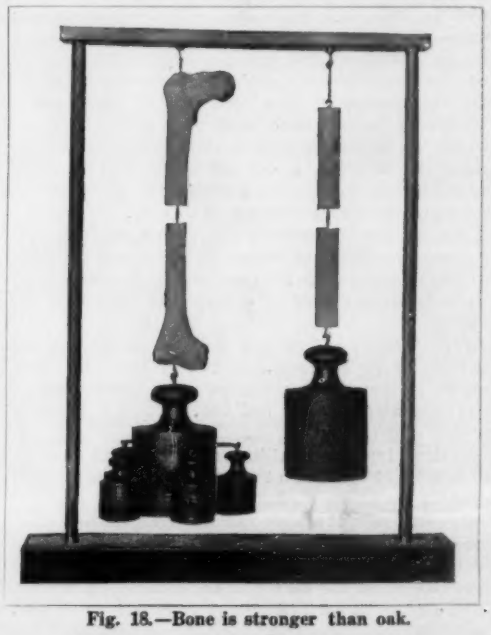


Fig. 18.—Bone is stronger than oak.

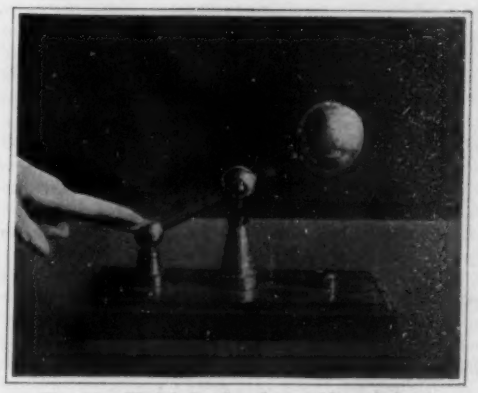


Fig. 19.—Model showing force of heart's beat.

Fig. 20.—The use of clothing.

Illustrations by courtesy of *Illustrirte Zeitung*.

EXHIBITS AT THE INTERNATIONAL HYGIENIC EXPOSITION, DRESDEN

little detailed description of this section that can be given in this article will best be presented in connection with the few illustrations here reproduced.

Figs. 10, 11, 12 and 13 relate to water and its impurities. Fig. 10 shows an open well lined with a wall of stone and situated near a farmhouse and stable. Not far off is the village pond, on the shore of which stands a small slaughterhouse. The water of the pond, filled with impurities derived from the slaughterhouse, the washing of clothes and many other sources, seeps through the soil to the "ground water" which supplies the well. Other water carrying impurities from the stable and dung heap, drains, etc., enters the well through fissures in the wall, and dust and other things fall into the open mouth, so that the well water is necessarily impure, and may contain germs of typhoid and other diseases. The conditions shown in Fig. 11 are little better. The well is covered and provided with a pump, and is apparently protected from surface impurities by the impervious stratum of yellow loam which it traverses in its descent. But the wall and the wooden cover of the well in time develop fissures which admit impure water from the ditch at the left and from other sources. Moreover, a cesspool (shown at the right) of later and very faulty construction, also penetrates below the stratum of loam, and directly contaminates the ground water. Such wells often cause epidemics which are carried through a whole village in various ways: for example, a careless baker who allows a washerwoman to test the freshness of his bread by squeezing the loaves with her wet hands.

The pump well shown in Fig. 12 is apparently well protected by layers of cement and clay, and the cesspool is made tight by the same means, but the ground water is contaminated by neighboring sources of impurity.

Fig. 13 shows a deep pipe well, driven through one stratum of yellow loam and two of blue clay. The water is thoroughly protected from contamination from the surface above and near it, and is probably pure.

Various types of dwellings are illustrated in Figs. 14 and 15. Beginning at the left of Fig. 14, the first drawing shows an ancient Hebrew house, which consists essentially of a high wall inclosing an open night shelter. The second dwelling is the primitive hut of the Indians of the Amazon, consisting merely of a roof placed on the bare ground, without walls. The third picture shows a model of a farmhouse in Saxony, with the roof turned up to show the interior. The sleeping- and living-rooms, kitchen (usually chimneyless), barns and stables are all under one roof and within one wall, in defiance of the most elementary hygienic requirements. The fourth dwelling is a Canadian Indian wigwam. The tent is one of the most primitive of human dwellings, and is found chiefly among hunting and nomadic tribes. The open top of this Indian tent is provided with flaps to control the outflow of smoke. Behind the tent is shown a fence which serves as a wind shield, and to right and left are stacked the sledge poles on which the tent and other possessions are carried on journeys. The fifth and last dwelling shown in Fig. 14 is an African Herero hut, consisting of an inverted plaited basket, like an old-fashioned beehive, plastered with clay and cow dung. The first (left hand) drawing in Fig. 15 represents a vertical section of a Point Barrow Eskimo hut, built of logs and covered with snow as a protection against cold. The hut is entered by creeping through a low doorway. The second picture shows an Italian peasant's house. The interior is dark and uncomfortable, the windows are not glazed, the roof is flat, and is a favorite evening resort. The third picture shows an ancient German hut, built of tree trunks wattled with brush. Huts of this type are still used by primitive tribes in various parts of the world. The fourth picture shows a prehistoric German earth-dwelling, consisting of a pit surmounted by a dome of brush covered with clay or moss. The fifth and last picture shows a farmhouse in the German Schwarzwald, in which house, barn and stables are combined, as in the Saxon farmhouse.

Fig. 16 shows a modern hygienic bed and Fig. 17 the old-fashioned alcove bed, which was apparently devised to prevent access of fresh air to the sleeper.

Fig. 18 illustrates the comparative tensile strength of human bone and of oak. A rod of bone having a cross-section of one square millimeter will sustain a weight of 15 kilogrammes, while a similar oak rod will sustain only 10 kilogrammes. By pressing the lever and raising the weight shown in Fig. 19, which represents the effort made by the heart in each pulsation, the visitor can obtain a practical idea of the great force of the heart's beat.

The effect of clothing in diminishing radiation of heat from the body is illustrated by Fig. 20. When the temperature of the air is 50 deg. F., the temperatures of the bare hand, the skin of the arm clad in a knit shirt and a woolen coat, and the other surfaces of the shirt sleeve and coat sleeve, are respectively 84.2, 89.6, 78.8 and 69.8 deg. F. Hence the difference in temperature between the coat sleeve and the air is only 19.8 degrees, while the difference between the bare hand and the air is 34.8 degrees, and the radiation from the clothed arm is correspondingly less than that from the bare hand.

The heating and cooling effects of hats and caps are illustrated in Fig. 21. In the sun, with an external temperature of 96.8 deg. F., the temperatures inside the hats are as follows: No. 1, yacht club cap, 98.6; No. 2, Prussian helmet, 97.7; No. 3, English cap, 94.1; No. 4, black derby hat, 92.3; No. 5, high silk hat, 89.6; No. 6, soft white felt hat, 86; No. 7, light straw hat, 79.9; No. 8, Panama hat, 77.9 deg. F.

The First International Congress of Aerial Law

ON May 31st and June 1st and 2nd, the First International Congress of Aerial Law met in Paris under the auspices of the *Comité International Juridique de l'Aviation*. The efforts of the committee are directed especially to the establishment of practical regulations for aerial traffic as such regulations shall become necessary. The other objects of the committee are the collection and preservation, in a central place, of all interesting cases and documents relating to aerial law, the discussion and preparation of laws passed by parliaments and local authorities, and the imparting of information and advice to societies and individuals who may present questions concerning the legal aspects of aerial traffic. In some cases the committee may assume the role of arbitrator in disputes.

The committee has undertaken the preparation of an aerial code consisting of five sections (general public rights, private rights, police ordinances, custom house regulations and penal laws).

In a recent issue of the *Deutsche Zeitschrift für Luftschiffahrt* the work of the International Committee is thus described by the head of the German delegation, Dr. Alex Meyer:

The separate chapters of the code tentatively adopted by the international committee are submitted to each national delegation and the result of the deliberations of each national delegation is communicated to the international delegate in Paris. The diverse views thus collected from all the countries are discussed at the monthly sessions of the international committee, and form the basis of a provisional chapter, the definite form of which is established at the annual international congress.

The first congress, just held, determined the method of voting, and drew up the first five chapters of the code, relating to general public rights. It was decided that each country represented should have one vote. The five chapters as adopted read substantially as follows:

CHAPTER I. GENERAL RULES OF AERIAL TRAFFIC.

Article 1. Aerial traffic is free, with the reservation of the right of each State to make certain regulations for the space above its own territory, for the preservation of its own safety and the lives and property of its inhabitants.

CHAPTER II. NATIONALITY AND REGISTRATION OF AERIAL VESSELS.

Art. 2. Every aerial vessel must have a single nationality.

Art. 3. The nationality of a vessel is determined by that of its owner. When the owner is a company, the nationality of the vessel is that of the place where the company has its seat. If a vessel belongs to several owners of different nationalities, its nationality is that of the owner who possesses a two-thirds interest in the vessel.

Art. 4. Every vessel must bear an easily recognizable mark of nationality.

Art. 5. Every vessel must carry papers of identification containing all necessary information.

Art. 6. No owner of an aerial vessel may extend his flight beyond the limits of an aeronautic park unless the vessel has been registered in a list kept by the proper authorities. Each State shall make rules for registration in its own territory.

Art. 7. Every vessel must carry a mark indicating its place of registry.

Art. 8. The registration list shall be published.

CHAPTER III. LANDING.

Art. 9. Landing in open fields is permitted.

Art. 10. It is forbidden to land in fortified places or within a radius established by the military authorities, or within towns and cities except in open spaces designated by the authorities.

Art. 11. The owner of the vessel shall be liable for all damage caused by landing, except in so far as such damage is caused by the fault of the party injured.

CHAPTER IV. JETTISON.

Art. 12. Jettison includes all voluntary dropping of objects from the vessel.

Art. 13. Except in cases of imminent peril it is forbidden to drop any object which can injure persons or property in any manner.

Art. 14. In case of injury so caused, the owner of the vessel shall be held liable.

CHAPTER V. WRECKED AND ABANDONED VESSELS.

Art. 15. Every person who finds a damaged or abandoned aerial vessel, or any part thereof, must notify the proper authorities.

Art. 16. The authorities so notified shall immediately take proper measures to preserve the wreck and restore it to its owner.

Art. 17. The owner may claim his property at any time within one year from the day of discovery and after he has paid the cost of salvage and preservation. The owner is also required to pay to the finder a reward equal to 10 per cent of the value of the recovered vessel, after all costs have been paid.

Astronomical Notes for Amateurs for August

By Rev. Ruel W. Roberts

THE summer is the best season of the year for observing and studying the heavens. It is warm and the open air invites us all. It is especially favorable for the use of a telescope, for the "seeing" is much superior at this time. An instrument is worth one twice its size used in the winter season. For these reasons we give below some notes with the hope that they will guide those interested in the study of the heavens.

The Asteroids.

During the month of August Ceres, Juno, Pallas and Vesta may all be seen. As will be seen from the ephemeris given below Ceres passes just to the north of Eta Geminorum (R. A. 6 hr., 9 min.; Dec. north 22 degrees and 32 min.), about midnight on the 4th. It will lie about half a degree to the north of this star at this time. About noon of the 9th it will be directly north of Mu Geminorum—about half a degree above it. The R. A. of this star is 6 hr. 17 min. and its Dec. is N. 22 degrees and 33 min.

Pallas is in the constellation Eridanus and toward the close of the month passes near the star 30 in this constellation. Juno although of nearly the eleventh magnitude should be seen in a fair sized telescope on the 20th when it is about a half degree above Zeta Virginis. The R. A. of this star is 13 hr. 30 min., and its Dec. is south, 8 min. Vesta is constantly growing brighter during August and at its beginning is near Delta Geminorum, and for a short time traces very closely the path of Neptune for the early spring. We give below the ephemeris for these asteroids:

CERES.

Mag.	Date.	Right Ascension.	Declination.
8.71	Aug. 4	6 hr. 8.3 min.	N. 23 deg. 3 min.
	Aug. 12	6 22.0	23 14
	Aug. 20	6 35.4	23 21
8.53	Aug. 28	6 48.5	23 26

PALLAS.

8.74	Aug. 4	3 hr. 25.9 min.	S. 2 deg. 28 min.
	Aug. 12	3 35.8	3 40
	Aug. 20	3 45.0	5 5
8.39	Aug. 28	3 53.5	6 44

JUNO.

10.74	Aug. 4	13 hr. 14.2 min.	N. 0 deg. 59 min.
	Aug. 12	13 21.6	0 10
	Aug. 20	13 29.5	S. 0 41
10.94	Aug. 28	13 37.8	1 33

VESTA.

8.65	Aug. 4	7 hr. 17.5 min.	N. 21 deg. 50 min.
	Aug. 12	7 32.2	21 30
	Aug. 20	7 46.6	21 6
8.53	Aug. 28	8 0.8	20 39

Occultation of Stars by the Moon.

In our article of April 1st attention was called to the pleasing experience of watching a star suddenly dart behind the moon during an occultation. Below is given the Washington Mean Time of Immersion and Emersion of three stars which may be watched during August.

Date.	Star's Name.	Time of Immersion. Hr.	Min.	Time of Emersion. Hr.	Min.	Mag.
August 5th. . . .	10 G. Sagittarii	10	17 P. M.	11	2 P. M.	5.7
August 9th.....	35 Capricorni	8	21 P. M.	9	28 P. M.	6.0
August 10th, ...	37 Capricorni	2	3 A. M.	3	19 A. M.	5.7

Planetary Details to be Observed.

On August 28th the moon passes very close to Jupiter. Mercury is at its greatest elongation east of the Sun on the morning of the 13th and should be watched for about this time of the month, in the evening sky. It represents a crescent of about the same as the quarter moon at this time. Venus is at its greatest brilliancy on the 10th and is at this time half way been a quarter-moon crescent and a new-moon crescent.

The New Era of Blood-transfusion

A Triumph of Surgical Skill

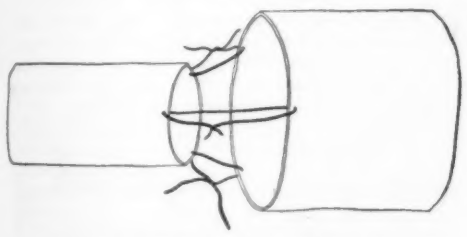
By Genevieve Grandcourt

IT is not seldom that we read newspaper accounts like the following, which appeared early in the year:

"Philadelphia, Feb. 20th.—With a subject selected from the score or more volunteers who had offered their blood in response to a want advertisement that appeared in a newspaper here this morning, a remarkable transfusion operation was performed to-night in the Polyclinic Hospital. The patient was David Poloco, a poor tailor suffering from internal hemorrhages, whose family had already given all the blood their physicians would allow, and had advertised to give their savings for a volunteer in a last effort to save the life of their relative.

"The subject, who hid his identity under the name of 'Smith,' was a powerful looking man about 26 years old who came to the hospital in a taxicab and is said to be a member of a prominent family in this city.

"The transfusion was permitted to continue for thirty minutes, when the white face of the patient had assumed a rosy hue, while the face of the subject, which at the beginning of the operation was ruddy, had become almost deadly white. An examination of the blood of the two men at the close of the operation showed that the coloring matter in Poloco's blood had risen from 18 to 47 per cent, while that of the subject had decreased from 85 to 69 per cent."



First stitches or stay-sutures.

CARREL METHOD

Dr. Crile of Cleveland, who more than anyone else has *developed* transfusion (the name of experimenters in the past two hundred years is legion), says that he meets with the warmest enthusiasm in asking relatives to make this sacrifice, while Dr. Carrel describes the moral exaltation of a young man who gave his blood to his aged father. It would thus seem that the victory registered over the material is as blood-stirring as the surgical triumph of transfusion itself.

Not that the operation is any longer dangerous. Professional donors of blood have been known to return to hospitals two and three times to repeat the experience; they are often in condition to work the next day. The ordeal is painless. About half an hour beforehand, each patient is given a hypodermic injection of morphine. Local anaesthesia is used, a small cut being made over the vessels.

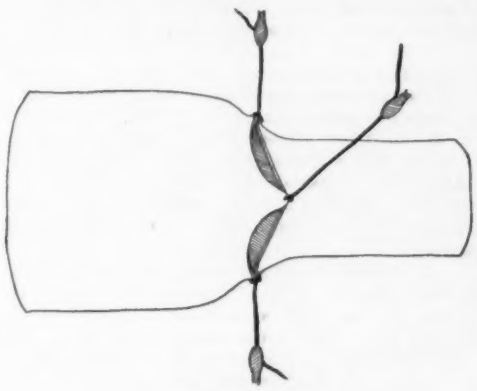
Reducing the surgical history of transfusion into its elements, it began with one Frenchman and was concluded by another; one in the 17th, the other in the 20th century—Jean Denys, who performed the first real operation of the kind; and Alexis Carrel, who found the way to suture the ends of severed blood vessels.

Denys, through animal-experimentation, arrived at conclusions as to choice of blood-vessels in transfusion which are held valid to-day. He showed that the artery (as carrier for the quick-flowing red blood) should furnish the supply, and the vein of the sick man should be selected to receive it, as affording the most direct route back to the right heart and the lungs where the blood becomes re-vitalized. Artery and vein he connected with glass-tube.

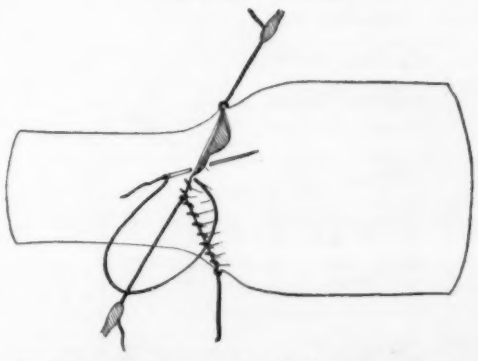
He was not sustained by the professional opinion of his time, partly because Harvey's discovery of the circulation, though forty years old, was still ridiculed in Paris, but also in view of the demonstrated negligible quantity of blood capable of being transfused. It had been known for a long time that endothelium, lining arteries and veins (now known as the intima), has the property, practically peculiar to itself, that blood in contact with it does not clot, while, when brought into contact with any other substance, it soon coagulates and ceases to flow.

Denys found that the amount of blood transfused varied according to the size of tube used, and also according to the different size of human and sub-human blood-vessels; though he knew there was no way of satisfactorily gaging the flow save by the pulse of the donor which during the operation must be transmitted from artery to vein. As little as four ounces had brought patients out of syncope, and failure in one case that had promised well, was found on post-mortem to be due to intestinal gangrene.

After initiating the work, he got into trouble. In transfusing blood from the femoral artery of a calf into the veins of an insane man, he was twice successful; but the third trial, made at the insistence of the patient's wife, resulted fatally. Denys was suspicious and wished to open the body. The widow refused, saying he had "experimented" on her husband, and demanding a price for her silence. The doctor's answer was a complaint to the authorities, and in the sequel the French government prohibited the practice.



Tying of stay-sutures.



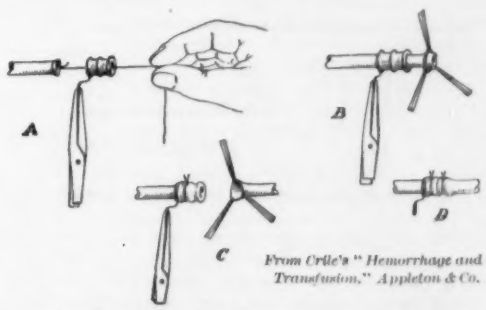
Final suture of artery and vein, showing over-and-over stitches completed between two of the stay-sutures.

CARREL METHOD

From this time until early in the 19th century, this operation was taken up, dropped and taken up at intervals until the method came into vogue of drawing blood from the subject, whipping out the clots (*defibrinating* it) and injecting it into the patient's veins.

Against this method, the great French physiologist, Magendie, gave early warning. His experiments showed that in this way serious symptoms could be made to develop in perfectly healthy animals; and he suspected that the clotting took place now inside the body instead of out, producing paralysis and death. During the Franco-German war, this method was tried on thirty-seven wounded soldiers with only thirteen successes.

A few years later, science began taking those enormous strides which especially in physiology and biochemistry have covered more ground than in all preceding history. It was learned that that microscopic body, the white corpuscle, was back of the blood-clot; that when the ends of blood-vessels were cut, it began to manufacture fibrin-ferment. Hence, defibrinating the blood did not solve the problem, as only the solid part of the clot was whipped out and the white corpuscle's fibrin-ferment remained in the blood. And it was only when this clotting inside the blood-vessels did not take place in a *vital* organ that Magendie's prognosis was not realized.



From Crile's "Hemorrhage and Transfusion," Appleton & Co.

A. Vein being drawn through ring. *B.* Cuffing vein over ring, showing hemostats. *C.* Vein tied in groove next handle of ring; artery in position to be drawn over vein. *D.* Complete anastomosis of artery and vein.

CRILE METHOD

Thus the only solution was to join the ends of the blood-vessels together so that, as regarded the circulation, they should become one. But stitches seemed out of the question, since, being foreign bodies, they were as objectionable to the white corpuscle as tubes of glass or paraffine. Yet, if hazardous operations of various kinds ever were to be made safe, to be able to join blood-vessels end-to-end was imperative.

Payr answered this call with a magnesium-tube, but the technique was undeveloped and proved clumsy. Meantime, Carrel was investigating with the blood-vessels of dead human bodies; he applied his technique to living animals, and it worked. He had found the way to do that which everyone had said could not be done, to *sew* the blood-vessels together without clotting or leakage.

The principle of the Carrel method consists in "everting" (turning out) the cut lips of the vessels in such a way that when the openings of the two are brought together, their linings touch. Needle and thread is then drawn through *sterilized vaseline*, passed through the outer and upper edge of the artery in its entire thickness, and brought out through the inner and upper surface of the vein. Two similar stitches are made in the blood-vessels (see diagram), in all instances leaving about four inches of thread uncut after tying, to serve as a handle for the assistant surgeon to tilt the blood-vessels in order to join them end to end, as shown in the accompanying illustration.

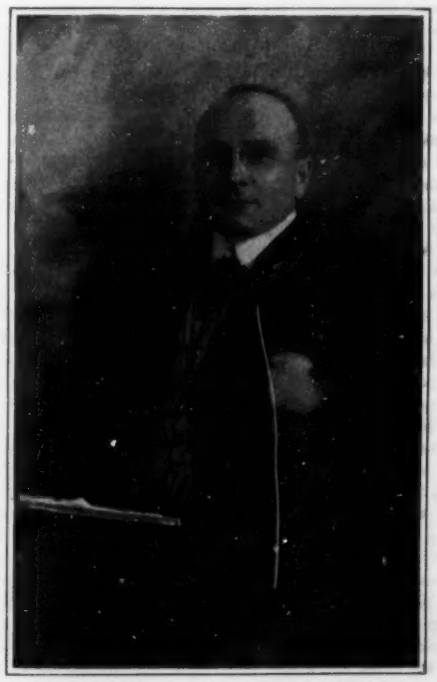
Carrel's discovery was hailed with thanksgiving, and he made an early application of it in transfusion by saving the life of a four-day-old baby; this as recently as 1908.

Dynamics.

Before Carrel's success, Crile was studying to develop transfusion along mechanical lines. He used Payr's tube, discarded it for Carrel's stitches; and then deciding that the less skillful surgeon needed an easier method, developed the Payr-tube. The instrument he has evolved is a cannula or ring-with-handle, and is so tiny as scarcely to slip over the point of a pencil.

The Crile method is to draw the vein *through* the ring and cuff its edge back *on* the ring; there it is

(Continued on page 139.)



Dr. Alexis Carrel, who discovered a way of sewing blood vessels together.

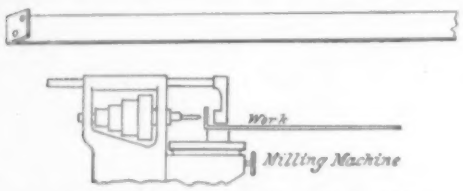
[The Editor of Handy Man's Workshop will be glad to receive any suggestions for this department and will pay for them, promptly, if available.]

Drilling an Awkward Piece

By G. H. Ander

THE following may be worth while to many, as it was to those it concerned, when it happened.

I was working in a railroad repair shop one day when I observed two machinists working a ratchet drill in order to make holes in a piece of iron about 12 feet long, with one end bent up about 8 inches. The holes were being made in the short part (see illustration). The shape of the iron to be bored or



Drilling an awkward piece in a milling machine.

drilled prevented it from being done in a drill-press or lathe.

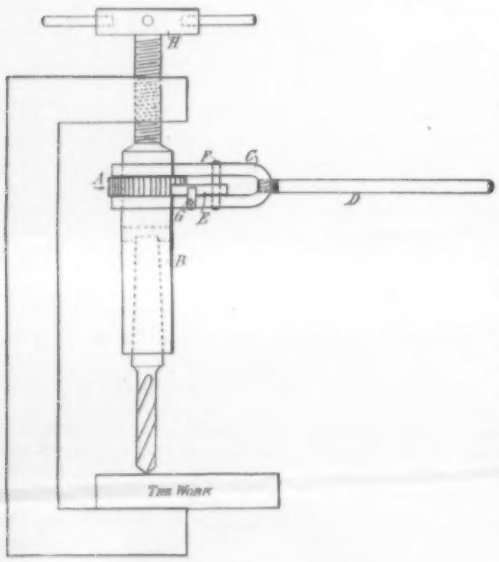
The men had the iron and ratchet drill with its holder clamped to an iron table and were working hard for a considerably long time to make the holes.

I asked the foreman if there were many jobs like that in the place. "Yes," he said, "we have had to make quite a number of them in the last three years, and we will have many more." Then I said: "I suggest that you drill those holes by using that milling machine" (pointing to one which was used very seldom). "Well, well," he exclaimed, "I never thought of that before, and neither did the machinists who were told to perform the job." After that the holes were always drilled in the milling machine by one man and naturally in very much shorter time than it used to require two men with the ratchet drill.

How to Make a Ratchet-drill

THE ratchet drill here illustrated will be found extremely handy around the house for quick repairs. Take an old milling machine cutter that has seen its best days and anneal it. This will make as good a ratchet wheel as you want.

A ratchet wheel, *A*, should be keyed on the drill carrier or spindle *B*. Then bend a piece of strap iron



A home-made ratchet drill.

to a U-shape as shown at *C*, and drill a hole in the end of the U-shape iron, so it will be a neat sliding fit over the spindle *B*. A hole must also be drilled in the outer end of strap iron, so that a piece of round iron or pipe can be screwed in position so as to act as a handle, shown at *D*. A dog, *E*, is pivoted upon a pin, *F*, and a spring, *G*, holds the dog against the ratchet wheel, *A*. While drilling a hole the drill is fed into the work by means of a feed screw, *H*, which is provided with four pins as shown in the head of the screw, thus making it easy to feed the drill into the work. The feed screw, *H*, has a female center which fits over the center of spindle, *B*. The ratchet held in this way will be held very rigid. The spindle is made so it will take any size of drill having a No. 1 shank.

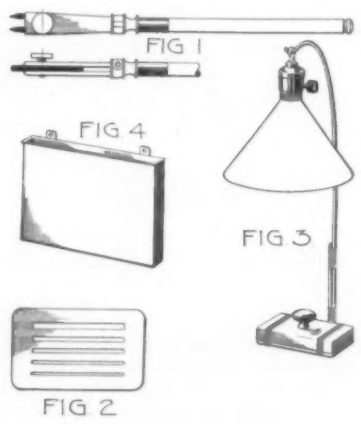
Drafting Room Kinks

By John D. Adams

ON drawings where the lettering is considerably scattered and some degree of uniformity is desired, it is quite essential that some rapid means be provided for drawing the pairs of parallel guide lines. Measuring is altogether too slow. In most drafting rooms will be found one of those rather large, obsolete, right-line pens. Cut off the points, as shown in Fig. 1, insert two chisel-pointed leads, and tighten the screw. When adjusting the distance between the leads it is only necessary to partially loosen the screw, after which the leads may be pushed in or out. This instrument is very rapid, and requires infrequent sharpening.

Fig. 2 illustrates another method of accomplishing the same end. A piece of transparent celluloid is provided with a series of slots of different widths. Although this little device is common, it is not to be found in any of the catalogues. It is superior to Fig. 1 where the lettering must not only be uniform, but of certain standard heights.

The writer has used several excellent forms of



Drafting room kinks.

lighting fixtures for the drafting table, but none that gave more satisfaction than the little light shown in Fig. 3, which was improvised in the course of a half-hour from a piece of heavy copper wire and a paper weight. On one end of the copper wire a hook is formed. The wire then curves downward toward the base, where it is bent into a rectangle the size of the paper weight. The extra length of wire is then carried upward and neatly bound to the vertical section. Two pieces of cord serve to connect the wire securely to the paper weight, and also to keep the base from scratching the table top. The electric cord in leaving the socket is fastened to the hook, from which it may be run directly to the outlet, or else down the curved copper standard and once around the knob on the paper weight. The latter is the better method. A shade of Bristol board answers every purpose, and the resulting lightness of this feature, as well as the upper works in general, renders the lamp very stable and easy to shift.

For those who have too little office space to accommodate the usual horizontal blueprint tank and yet find it necessary to make a few prints occasionally, the vertical tank shown in Fig. 4 will be convenient. This need be only an inch or two in thickness, so that the space it occupies is negligible. One or more wires running longitudinally across the top will serve to hold the prints while washing. The writer has seen a print two by three feet washed in one of the stock metal tubes used for keeping blueprint paper. These tubes are about two and a half inches in diameter and have screw tops.

In Fig. 5 is a suggestion to draftsmen who have to use special curves very frequently. A piece of transparent celluloid, which may be obtained at most stationers, is placed over the pencil outline of the desired curve, which is then marked off. The curve is then cut out with the shears and smoothed up with file or sandpaper. A piece of cardboard will serve to keep the celluloid far enough away from the paper to permit the use of the ruling pen.

There are comparatively few draftsmen who fully appreciate the possibilities of the ordinary flat machinist scale. With a little practice this form of scale may be readily handled on edge in which position spacing may be done with almost mathematical accuracy, as a sharp pencil point fits into the small grooves that mark the distances on the scale. In fact, there is probably no other method by which a point can be placed accurately and quickly.

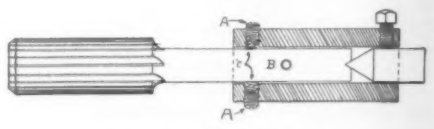
Supposing that in Fig. 6 it is desired to subdivide the space between the two parallel lines into thirteen equal parts: Simply place the scale at a suitable angle to the parallel lines so that thirteen equal divisions—in this case quarters—exactly reach from one line to the other. Run the pencil point down each quarter mark, and the spacing is done.

Floating Reamer for Lathe

By H. D. Chapman

THE accompanying engraving shows how a floating reamer can be made and the way it is used.

For very accurate work the floating reamer has come to be the standard. This style of reamer the writer has used very successfully on a lathe.



Floating reamer for lathe.

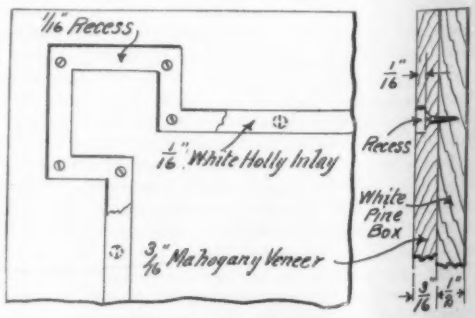
The reamer is held in a holder as shown, the holder is bored about ⅛-inch larger than the body of reamer. This is done so as to allow the reamer free movement. The reamer is held as shown against a center at the back and it has a pin through it at *B*, which prevents the reamer from turning. The hole that is drilled through the holder should provide about ⅛-inch clearance, so that the reamer can find its center while in use. There are four springs shown at *C* which are used to adjust the reamer into alinement with the work. These springs are held in position by means of set screws *A*. This reamer has now been in service for about two years and is used for reaming draw tubes for telescopes.

A Novel Method for Attaching Veneer

By R. C. D.

SOME time ago the writer had occasion to veneer a large box with mahogany. Not having the necessary facilities for glueing the veneer and clamping it in place until it was thoroughly set, as is the usual method, he proceeded to attach it as shown in the accompanying illustration. It is a simple method, and one which gave excellent results.

The mahogany was about 3/16 inch thick, and it was to be inlaid with 1/16 inch white holly. The recesses for the inlay were first cut out. The mahog-



Method of attaching veneer.

any was then placed in position on the box which was of white pine, and was firmly attached to it by means of screws which were placed at various intervals in the recesses. The heads of the screws were countersunk into the bottom of the recesses as shown. The white holly was then laid in the recesses and secured in place with glue and thus all traces of how the veneer was held in place were completely hidden.

This is a trick worth knowing and it may come in handy for a number of our craftsmen friends who have like work to do.

The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting

The British Inventor: His Decadence and the Remedy.

IN an article published in the London *Engineer* Mr. W. O. Horsnaill analyses the reasons why England has fallen behind other nations as regards the evolution of useful inventions.

In its editorial columns, the *Engineer* firmly declines to agree with Mr. Horsnaill in the assumption that British invention is at all in a backward state, and cites the British man-of-war. "From beginning to end," states our contemporary, "she is the product of British imagination, British thought and British skill, and it will not be denied that she contains a collection of inventions for which it would be hard to find an equal outside of an international exhibition. We are not going to attempt the impossible task of separating the details of her contents according to the nationality of thought which first inspired them, though, if we did so, the preponderance of British inventiveness would be enormous, but we shall content ourselves by pointing out that nearly every one of the million details which may be found within her walls has been thought out in British drawing-offices."

Mr. Horsnaill states that the attitude of the British manufacturer toward new inventions is one of apathy, coupled with extreme skepticism. The manufacturer can be induced to take up a new patent only under an agreement giving him the lion's share of the profit, while the inventor is saddled with all the risks.

"The majority of ideas cannot be put into workable shape without patient and often costly experimenting, hence an inventor without means of his own must apply either to a capitalist or a manufacturer for assistance. The former is very chary of risking his money on such ventures, in view of the attitude of the manufacturer indicated above, and the latter, if he can be persuaded to take any interest at all in the idea stage, will suggest employing the inventor under an agreement by which he surrenders all claims to any improvements resulting from his efforts. This state of things compares unfavorably with the attitude of manufacturers towards inventions in certain other countries who now give us the lead in this line.

"In view of the epoch-making inventions brought out by British enterprise during the last century, it is difficult to believe that our inventors are suffering from any lack of originality, this view being further supported by the large and increasing number of applications for letters patent. Such being the case, we are driven to the conclusion that the chances of a reward, which were good enough to attract the best brains in the country thirty to fifty years ago, have now become too remote to act in this way, with the result that our manufacturers have been reduced to copying the inventions of other nations. There is little room for doubt that the position is mainly governed by the attitude of the manufacturer both as regards the independent inventor and his own employees.

"It is not intended to suggest that the majority of the British firms make no recompense whatever to workpeople who bring forward valuable inventions, but the reward is generally in the form of a small increase in salary, which may, and often does, end after a short period owing to a revision of the staff appointments. Only a very few manufacturers employ experimenters whose whole duty consists in developing new products, and the chances of a small increase of salary for an uncertain period are not sufficiently attractive to induce inventive efforts in those who have been engaged for other duties; hence, if a good idea is thought of, the experienced assistant will keep it to himself until he secures a new appointment, when protection can be obtained between engagements.

"It is difficult to understand what objection there can be to paying a small royalty to a workman. It would have to be paid to an independent inventor, and, after all, the firm is placed under no permanent obligation, as the royalty ceases with the manufacture; moreover, much better terms can be arranged than would be practicable in taking up the invention of an outsider. It is only fair to state that certain enlightened firms have been very liberal with members of their staff who have brought out new inventions and such concerns have greatly benefited by this procedure, but the general rule is to give no royalties to workmen, whether engaged for experimental work or other duties."

Mr. Horsnaill believes that one reason for the lack of English success in the direction of new inventions is the neglect of experimental and research work by manufacturing concerns. This plan is in marked contrast to the methods pursued in Germany, where almost every large works has a number of men continually engaged in experimental and research work, no attempt being made to economize in this department, even during periods of depression.

"Often the cost of manufacture is entirely ignored, but it is obviously useless to protect a device which cannot be made for a price at which it is likely to sell.

"It would appear that an inventor, if he is not an expert in the industry to which his idea applies, would often be well advised in consulting some one whose knowledge and experience would enable him to say whether the invention was likely to prove successful, and this course should be pursued before any money is spent upon taking out a patent. It will no doubt be contended that by such procedure the inventor risks having his idea taken from him for the use of some one else. If, however, care is exercised in the selection of an expert, this risk should be infinitesimal, and in the case of a useless invention the outlay upon patent fees, experiments, models, and attempts to sell, are saved.

"Then, again, expert knowledge is necessary for the perfecting of an invention before any attempt is made to place it on the market, and if the inventor does not possess such knowledge he should certainly seek assistance.

"Many good inventions have failed because they have been offered to manufacturers in an imperfect state, backed up by inefficient designs and carelessly constructed models. The drawings of the invention, and the workmanship of the model, are most important when it is desired to sell a patent. A number of mechanical inventions have made a market for themselves without possession any merit whatever, excepting they have been well designed and made, while others, with novel and useful features of considerable value, have failed to receive recognition owing to the careless way in which they have been put forward."

Notes for Inventors

A New Way of Hanging Clothes.—A city dweller once built his garage on the back of his home lot, shortening his yard and causing the women folks to complain of lacking space to hang the family wash. "Oh!" he said, "I'll fix that." He ran two small iron pipes, which had formed parts of an awning frame, lengthwise along and supported from the side fences by brackets which spaced the piping away from the fences. Then the clothes line was laced from side to side of the yard around the opposite pipes. When a row of wash was hung, it could be pushed along close to the preceding row, so that the capacity of the yard was equal to, if not greater than, that of the entire original yard when hung in the usual manner.

A Perpetual Motion Inventor and His Practical Suggestion.—Misdirected effort is frequently found in the pursuit of inventions, and we read of the death a short while ago of a Baltimore inventor eighty-eight years of age who is said to have spent fifty-five years of his long life seeking perpetual motion. At the same time we read of the old man's evidencing his natural and developed inventive ability by suggesting to a relative, as a wedding present, a reaping invention which is reported to have realized one million dollars or more. If this be true, his inventive talents can hardly be said to have been given him in vain.

A Parsons Turbine Gearing.—In a patent, No. 997,635, Charles Algernon Parsons of Newcastle upon Tyne, England, provides for the running of turbine elements at their most economical speed independently of the speed of the propeller shafts. He does this by combining, in the turbine installation, one or more propeller shafts with a plurality of other shafts and gearing between said shafts, together with turbine elements some of which are reversing turbine elements distributed over all the shafts, all arranged to secure the economical speed of the turbine elements.

Recent Patents for Treatment of Refractory Material.—The treatment of refractory material is involved in five patents, Nos. 997,879 to 997,883, issued to the General Electric Company, assignee of Ezechiel Weintraub of Lynn, Mass., and Schenectady. The same company is assignee of patent No. 997,940, to Elihu Thomson of Swampscott, Mass., for a method of generating high temperatures, in which the vapor is generated in a conduit of relatively unrestricted bore by heating the conduit externally, accompanied by other steps in the process.

An Observation Car.—An observation car in which seats are arranged sloping upwardly from both ends of the car to a central level portion is shown in a patent, No. 997,704, to Richard M. Rodden of Montreal, Canada.

Cleaning Glass Dry.—In a patent, No. 997,447, Samuel Grimson of New York city provides a dry cleaner for glass, in which a cleansing surface of tripoli powder is held to a suitable backing by a minute coating of vaseline, which will hold the tripoli to the backing without passing through the powder.

A Parachute for Aeroplanes.—A safety attachment for aeroplanes has been patented, No. 997,354, by Grover C. Younggreen of Los Angeles, Cal., and includes a sheet of fabric which may be folded in triangular form into a vertical plane to promote lateral stability of the aeroplane, or may be folded into a horizontal plane to act as a parachute.

Another Marconi Patent.—Guglielmo Marconi of London, assignor to the Marconi Wireless Telegraph Company of America, New York, N. Y., has secured patent No. 937,308 for a transmitting apparatus for wireless telegraphy. Any reference to the transmitter is necessarily technical, but the improvement includes a battery of low resistance with moving terminals arranged so that a gap is left between them, together with pieces to bridge the gap, which bridging pieces are moved, in operation, rapidly past the gap.

A Cup Packer for Wells.—A cup packer for wells, in which a cup formed of material which softens under the influence of liquid is combined with a spring of insufficient strength to expand the cup when dry, but can expand the cup when softened by the liquid, is presented in a patent, No. 997,721, to Charles A. Waitz of Rousville, Pa.

A Group of Safe and Vault Patents.—Twenty-five patents, Nos. 997,771 to 997,795, inclusive, have recently issued to Taylor Iron and Steel Company, High Bridge, N. J., as assignee of Samuel W. Fish of Plainfield, N. J., for safes or vaults, safe or vault doors, safe or vault bodies, safe or vault door holding means, locking mechanism for safes or vaults, and safe or vault door holding or locking means.

S. P. C. A. Horseshoe Prize.—Early in the year the American Society for the Prevention of Cruelty to Animals instituted a prize competition for a shoe which would prevent horses from slipping. The competition was to close on June 1st, 1911. We are informed by the general manager of the society that it is unlikely that any experiments will be made or decisions arrived at until the advent of winter, as the object is to find a shoe or device that will prevent horses from slipping on icy pavements.

The Death of Samuel T. Fisher.—Mr. Samuel T. Fisher, who was Assistant Commissioner of Patents during the Cleveland administration, died in Washington, Saturday, July 22nd, 1911. Mr. Fisher was a graduate of Harvard, subsequently taking a special course at the Massachusetts Institute of Technology to fit himself for work as a surveyor, which he followed in the United States service in Colorado and then returned to Massachusetts, studied law and accepted a position as assistant examiner in the United States Patent Office, rising to the assistant commissionership. Later he resigned to enter the practice of patent law which he followed with signal success up to a few months ago, when he was stricken with what proved to be his last illness.

A Waterproof Cellar.—In some sections ordinary cellars are impracticable, and James William Lane of Atlantic City, N. J., provides in a patent, No. 997,835, a waterproof cellar having a waterproof concrete floor and walls of considerable thickness with a vertical standpipe centrally on the floor and extending above the normal height of the water, in the surrounding sand, the standpipe having a filter and the standpipe being open at both ends, so that water may rise and fall freely therein.

A New Two-cycle Engine.—Charles Francis Jenkins of Washington, D. C., a well-known inventor especially in the moving picture apparatus art, has recently obtained a patent, No. 997,195, for a two-cycle gas engine including a longitudinal passage outside of the cylinder and within the water space of the same, one end of the passage being in open communication with the upper end of the cylinder while its lower end, in which a spark plug is located, is opened and closed by the reciprocation of the piston.

Doping Gasoline.—A real estate agent of our acquaintance uses a light runabout machine, and says he can get about eighteen to twenty-one miles out of a gallon of gasoline, but that he finds if he puts an ounce of laudanum to each five gallons of gasoline, he will increase the mileage per gallon from twenty to twenty-five per cent. Whether this is so or not—and no reason is seen why any such effect should result from the use of laudanum—it calls to our attention the use of additions to the explosive fluids for increasing their efficiency. The use of nitro compounds, such, for instance, as picric acid, have been suggested. As early as 1903 Le Mare, an engineer of Brussels, Belgium, obtained an English patent, No. 3,623, for an invention whose object was to increase the number of available calories for a given weight of fuel. He proposed an explosive fluid mixture combining 30 per cent of nitro-benzine with 70 per cent of alcohol. The fuel carried by motor cars should of course be as rich as possible in calorific energy, and a compound that can be provided for addition to the fuel charge of an automobile or motor boat should find a ready sale, if it can increase the mileage per gallon or can reduce the expense without adding to the dangers of operation. While some think the development of aeronautics will be greatly affected by improvements in the fuel products, others look for material improvements in the motors, and we have seen no less an authority than Hiram Percy Maxim quoted as prophesying that "in a few years we may get a thousand horse-power within the weight we now use for ten."

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

CONVERTIBLE COLLAR.—A. M. HAJEK, New York, N. Y. This garment improvement relates particularly to a reversible collar, which may be changed from a perfect normal to a perfect military collar. The invention provides a collar in which the outer or normally visible surface of the normal collar is perfectly protected from being soiled when reversed to form the military collar.

HAT GUARD.—A. WALLACE, JR., New York, N. Y. In this invention the purpose is to provide a new and improved hat guard for convenient attachment to a hat between the sweat band and the crown, and provided with a normally folded cord which can be readily unfolded and attached to the coat or other garment of the wearer, to guard against loss of the hat.

HOOK AND EYE.—A. F. WILEMAN, 70 Goldhurst Terrace, Hampstead, London, N. W., England. This invention refers to what may be termed safety-pin hook and eye fastenings; that is, fastenings which are provided with a pin serving, in lieu of sewing, for securing the fastening to articles of ladies' attire. The improvement consists more particularly in the method of securing a pin to each element of a fastening made from stamped-up metal.

Electrical Devices.

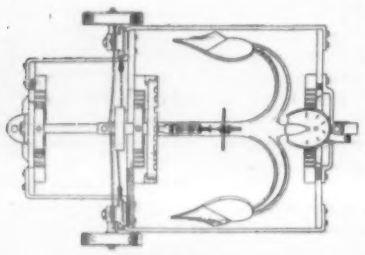
FUSE SWITCH.—A. L. WEEKES, Harpendale, Herts, England. This invention relates to fuse switches, that is, switches in which the current is caused to pass over fuses forming part thereof. Current is passed by way of one contact, spring switch blade, spring clip and fuse to the other spring clip, switch blade and contact. The arrangement of the fuse member at right angles to the switch arm so that two ends of the fuse and the switch blades move simultaneously away from the main contacts and in a parallel way is an important feature. The blades formed as spring members enable solid main contacts to be used.

TIMER.—G. T. BROWN, New York, N. Y. This timer is for use in controlling the closing of a plurality of electric circuits in succession and relates more particularly to the type of timer commonly employed with the electric ignition system of mutiple cylinder internal combustion engines. The timer is formed so that the length of time during which the contact is made, will be substantially uniform irrespective of the speed of the engine.

Of Interest to Farmers.

COTTON CLEANER.—A. L. TREESE, Jennings, Okla. Among the principal objects in view in this case are: To provide a mechanism for cleaning cotton by pneumatically eliminating the dust and dirt therefrom; to provide means for controlling the operation of the cleaner and to provide a cleaner which is continuous in its operation.

WHEELED PLOW.—JOHN N. THOLL, Rupert, Idaho. This invention is an improvement in reversible wheeled plows in which the frame to which the plow bodies are attached is adapted for adjustment relative to the main frame and the wheels, as required for plowing deeper or shallower and for holding the



WHEELED PLOW.

plows vertical or in due position for effective work. The frame of the machine is essentially rectangular, it being formed of metal side bars. A plan view is shown in the engraving. Means provide that one wheel is adjusted higher or lower than the other, and *vice versa*, whereby the level of the plow frame is preserved while one wheel runs in the furrow and the other on the unbroken land.

ANCHOR FOR WIRE FENCES.—J. RINEHART, Vanatta, Ohio. In this patent the invention is an improvement in anchors, and is designed to hold down the wire of fences between the fence posts to prevent the wire from being raised by hogs. The invention further resides in a driving block for sinking the anchor in the ground, with the the wire in place.

INCUBATOR LAMP CHIMNEY.—G. H. LEE, Omaha, Neb. Among the principal objects which the present invention has in view are: To provide a cover for a lamp chimney constructed to control the circulation of air in connection therewith to prevent heat loss by radiation, and to provide a cover for a lamp chimney so constructed as to extinguish the said lamp when same is caused to smoke to excess.

Of General Interest.

BOX.—W. W. BAIRD, Cleveland, Ohio. An object here is to provide a blank, which may be cut in one operation with very little waste and which may be quickly set up to form a box. Another object is to provide a box with no creases to weaken the walls of the box, the box being so constructed that when it is set up, the side walls cannot become dislodged, except when desired.

AUTOMATIC VALVE CLOSURE FOR WATER COCKS OR FAUCETS.—V. L. GARCIA, Buenos Aires, Argentina. The present invention relates to an automatic valve closure for water cocks or faucets, adapted to be acted upon by the pressure of the water itself. The body of the faucet consists of two parts screwed together and between these is a pure rubber disk which serves both as a valve and a means for making a tight joint between the parts of the body. Pure rubber keeps its elastic qualities without alteration within the water, as it is the oxidizing effect of dry air which deteriorates and destroys the rubber.

DRYING METHOD.—K. REITSCHER, Bielefeld, Germany. The method consists in passing the goods in two sections in opposite directions through two currents of air, each current passing over the dried departing portion of one section, then over the heater and then over the wet portion of the other section, whereby the air currents receive the preliminary heat by contact with the dried goods and are then heated by the heater, and finally come in contact with the entering wet goods to quickly dry the same prior to the latter reaching the exit portion of the drying chamber.

CLIP ATTACHMENT FOR PAPER ROLLS.—W. H. HULL, G. L. CUTLER, and A. A. BAUMAN, Gregory, S. D. By means of the attachment the operation of removing any required length of the paper from the roll is facilitated, so that it may be performed in about half the time required with the old attachment. Such rapidity of action is due largely to the fact that the end of the paper strip is held separated from the roll proper so that it may be conveniently and quickly siezed.

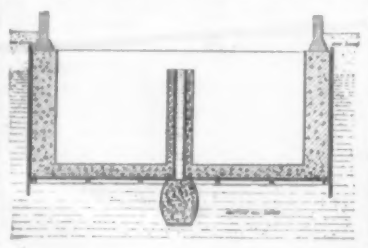
UMBRELLA CLOTH OR COVERING.—J. BISTER, Mamaroneck, N. Y. An umbrella covering made from the umbrella cloth is exceedingly serviceable and has high wearing quality, and arranged to properly shed the water, owing to the silk face formed by the silk weft threads extending outwardly to the selvage, which latter by its longitudinal ribs give a fine appearance to the umbrella.

PLATE METAL TUBING.—P. H. FRIEL, Kenosha, Wis. The invention provides a pliable covering material and a rigid body structure inclosed within the material and disposed to prevent the opening of the joint of the material; provides a sheet metal tube, the edges whereof are joined longitudinally and are provided with means for locking the joint to prevent the opening of the same; and provides a locking member for unfolding and holding the edges of metal, bent to form a tube, said member being disposed within the tube.

SPARK ARRESTER.—W. T. DEPUE, St. Louis, Mich. Mr. Depue's invention is an attachment for locomotive smoke-stacks and the chimneys of stationary furnaces for the purpose of arresting sparks and cinders and re-conveying them to the fire-box. It is only necessary to modify the apparatus in respect to size and in some cases slightly in respect to form to adapt it to various uses.

RUG DISPLAYER.—W. J. SMITH, Tiffin, Ohio. The purpose here is to provide a device for holding rugs in such manner that without injury to the rugs, they may be presented to the inspection of the purchaser to the best advantage, and wherein the rug may be easily released from the holding means when released.

WATERPROOF CELLAR.—JAMES W. LANE, 2015 Baltic Avenue, Atlantic City, N. J. In some seashore cities and other locations where sandy soil is permeated with water to a short distance below the surface, especially in Atlantic City, N. J., much difficulty has been encountered in providing perfectly water-tight cellars, and various methods have been adopted for the purpose, but without the desired practical success, until Mr. Lane's invention was put in use. In the accompanying illustration there is shown a vertical longitudinal section of a cellar constructed in accordance with the invention.



WATERPROOF CELLAR.

UMBRELLA OR PARASOL.—M. PERELL, New York, N. Y. In this patent, use is made of a stick, formed with telescopic sections, of which one is the handle section and contains a spring pressing the other or crown section, which latter carries the crown on which the ribs are pivoted, the runner being mounted to slide on the handle section, and being connected by braces with the ribs, the latter being connected by auxiliary braces with the handle section.

BOAT RELEASING HOOK.—J. JORDAN, Sydney, Nova Scotia, Canada. In this case the invention relates to a new and improved hook adapted to be used in supporting a life-boat or the like, which may be attached to the boat proper or to tackle, and which is adapted to automatically release the boat from the supporting members by the simple movement of a catch.

LIFE BELT.—F. JONATA, New York, N. Y. The invention relates generally to life belts and more particularly it involves an improved construction of simple form, the structure of which embodies the use of suitable material, such as canvas, having a plurality of ribs positioned at various points therein, one end of the belt being provided with a suitable valve whereby air may be emitted or exhausted from the belt.

EMBOSSING PRESS.—A. E. STIGBERG, New York, N. Y. The invention is an improvement in hand-operated presses, more especially for printing names and addresses on paper, and has in view a press in which the dies can be readily removed and replaced by other dies and conveniently and inexpensively procured. Means provide for the impression to be made at a considerable distance from the edge of the sheet.

WATCH FOB.—H. O. BECK, Atlanta, Ga. The object of this inventor is to provide a fob of flexible material having a pocket for containing a picture, or the like, wherein the picture is hidden from view, but easily accessible. The fob may be constructed of leather or other material, and may be stamped with suitable ornamentation. The fastener for the flaps is the usual glove fastener.

LOOSE LEAF BINDER.—C. F. MCBEE, Athens, Ohio. The improvement provides a binder more especially designed for use in railroad offices, manufacturing and commercial establishments and the like, and arranged for filing and subsequently binding loose leaves of tissue paper between two covers in an inexpensive manner without it being necessary to have holes previously punched in the papers.

HARROW.—L. O. EKREM, Calumet, Mich. In the present patent the invention has reference to harrows, and it has for its purpose to provide means for rotating the shaft to which knives are secured from the axle on which the wheels are mounted, and also means for raising arms to which the shaft is journaled, the arms being pivoted to the axle.

Hardware and Tools.

NUT LOCK.—J. B. FUNKHOUSER, New Brighton, Pa. This invention is an improvement in that class of nut-locks in which a locking device is used in connection with a washer in such manner as to engage the side of a nut and thus prevent its rotation. The locking device is so constructed and applied in connection with the washer and the nut as to lock both.

DIAL LEVEL.—J. O. OSTMAN, Hancock, Mich. An object of this inventor is to provide a folding level in which the usual tube of liquid having a bubble as an indicator is dispensed with, forming a stronger and more durable level and having an indicator that will respond more quickly to variations in level, and will show more clearly and closely the amount of variation.

SYSTEM OF LAYING OUT STAIR RAILS.—C. C. GRANT, Red Deer, Alberta, Canada.—This invention relates to systems for laying out stair rails and the like, for use by carpenters, builders and others, and relates more particularly to a system including in combination, means for holding the work, and a marker adapted to engage the work, and movable in a plurality of directions to permit the laying out upon the work of the outlines of the stair rail.

HINGE ADJUSTING DEVICE.—H. C. EMRICH, Washington, D. C. An object of this inventor is to provide means for accurately adjusting the hinge, so that a door in its closed position will be in exact alinement with the sides of the casing. The device can be applied to any type of double hinge with very little trouble, and by its means the door may be brought into position through the adjusting member, at any time after it is once hung, and with little effort.

LOCK.—R. FEOLA, New York, N. Y. An object in this case is to provide a simple, inexpensive and durable lock, which serves the purposes of the ordinary padlock, which, when in position, prevents the staples or eye-bolts from being filed or cut, and which renders difficult other unauthorized methods of opening the lock.

WIRE TWISTING TOOL.—D. A. CLAWSON, Waynesville, Ill. This tool is more especially designed for use in building wire fences, and arranged to permit twisting the vertical wire stays in between the line wires of the fence, twisting the ends of the wire stays around the bottom and top line wires without requiring rotating the handle of the tool around the wire, and allowing placing of the stay wires close together.

LATCH.—G. A. KLEIN and N. B. PIERSALL, New York, N. Y. The latch is adapted as a fastening for clothing, straps and general usage. It consists of two members, one a pocket normally open at the front, with an engaging spring overhanging the entrance of the pocket having a shoulder, the pocket having rigid side, bottom and top walls, and the other a head constructed to lift the spring in passing into the pocket, and provided with a shoulder for automatically engaging the shoulder of the spring when the head is nested in the pocket, and means are provided that present no projections on which clothing may be accidentally caught.

STRIKING LINE.—H. K. KISO, New York, N. Y. This invention comprehends a disk-like casing in which is revolubly mounted a drum and upon this latter the line is wound. The unwinding turns the drum in one direction, and it is retracted by a spring. The casing is provided with a sector-like opening, and fitting into this opening is a hollow door through which the line is drawn, and disposed within the door is the inking apparatus.

LAWN CLEANER.—C. H. MOSHER, Salisbury Mills, N. Y. The object here is to provide side members, to which are pivoted members carrying a shaft having rake teeth and a bar having hooks, the shaft being rotated by gearing connected by the wheels supporting the side members. The pivoted members are adjustable relatively to the side members, and means are provided for holding them in adjusted positions relatively thereto.

SAFETY RAZOR SHARPENER.—D. C. WILLIAMS, Arlington, Mass. This sharpener renews the edge of razor blades, and particularly that type known as safety razor blades, and used in such safety razors as the "Gillette." It will automatically sharpen simultaneously a plurality of edges of a blade. The device will also alternately sharpen the opposite edges of a blade in a continuous manner.

SHAVING SET.—J. W. HAWKINS, Passaic, N. J. The set contains in very compact form one or more ordinary razors, a strop, brush and soap, the arrangement being such that the strop can be conveniently placed in a stretched position above the casing for containing the enumerated articles. For the purpose mentioned the casing is made in two parts hinged together at adjacent ends, and the strop is supported at its ends on brackets carried by the casing parts.

FIRE EXTINGUISHER.—W. S. KELLOGG and C. E. SCOTT, Elizabeth, N. J. The invention comprehends more particularly means for liberating the acid at a point some distance below the surface of the alkaline liquid, in order to insure thorough and quick admixture of the acid and the alkaline liquid. The operator may cause the extinguisher to send forth either a liquid or a gas, and to direct the same, upwardly or downwardly.

Heating and Lighting.

FEED WATER REGULATOR.—C. O. BERGMARK, Chicago, Ill. The object of the inventor is to provide a new and improved regulator for use on steam boilers to regulate the flow of the feed water automatically, with a view of maintaining the feed water at an approximately uniform level, and to allow of filling the boiler beyond the normal level whenever desired.

APPARATUS FOR BURNING HYDRO-CARBON FUELS.—B. L. WORTHEN, Tucson, Ariz. The more particular purpose in this instance is to introduce finely comminuted carbonaceous material into a pre-existing flame, and to supply air or its equivalent at the point of contact between the comminuted material and the flame, so as to insure perfect combustion, economy of materials, and a high degree of heat.

FUSE LIGHTER.—H. W. FULLER, Globe, Ariz. This device is for use in igniting a fuse or fuses under water. It is intended for use especially with those fuses that are designed to explode charges in running operations. Many times excavated portions fill up with water, so that it is often hard to explode the charges since the ends of the fuses become wet and therefore do not ignite, even though the outside of the fuse is protected with a waterproof covering.

Household Utilities.

FOLDABLE BED BOLSTER.—F. HENGEL and J. ADDIS, New York, N. Y. This bolster is sanitary, and is arranged to permit convenient and quick adjustment and to allow ready folding of the parts for cleaning or storing purposes. For this purpose use is made of a tubular fabric cover, stretched over heads adjustably held apart by a rod extending through the cover and seated in sockets screwing in said heads.

ATTACHING DEVICE FOR CURTAIN STRETCHER.—J. O. HOLMQUIST, Chicago, Ill.

This invention has reference more particularly to a device which comprises a base adapted to be movably carried by a suitable part of the frame of the stretchers, an upwardly projecting holder adapted to engage the curtain or other article stretched upon the frame, and a guard adjacent to the holder.

PERCOLATOR.—J. J. O'MARA, New York, N. Y. This percolator comprises a main pot, a heating chamber having an opening within the pot, a percolating tube, a container for the coffee from which the infusion is to be made, and arranged to have the percolating tube discharge over the material therein, and a connection for removably associating the tube and the heating chamber, this connection forming a tortuous passage connecting the tube and the chamber with the main pot.

RECEPTACLE FOR CONDENSED MILK CANS.—W. L. KING, Pittsburg, Pa. The aim of this invention is to provide a receptacle in which may be disposed a can, a lid having an opening being provided for covering the receptacle and having a spout adapted to be disposed over the spout of the receptacle. Means provide for covering the space between the periphery of the condensed milk can and the inner wall of the receptacle, and for holding the lid in place.

WINDOW FASTENER.—G. W. STEIN, Chicago, Ill. In the present patent the invention has reference to means for fastening windows by a locking mechanism, and an object is the provision of a fastening device to be used for holding one sash in a fixed position with relation to the other which may be readily adjusted to permit the free movement of either sash.

WINDOW VENTILATOR AND FLY ESCAPE.—G. W. STEIN, Chicago, Ill. The ventilator may be brought into instant use at any time without the necessity of raising or lowering the window sash. It will permit a circulation of air therethrough, but at the same time prevent snow or rain from blowing in through the openings. It may be readily attached to any window.

Machines and Mechanical Devices.

CHOCKING MECHANISM FOR COMPRESSES.—W. HILL, Alexandria, La. The principal object which the present invention has in view is to provide an efficient and rapid means for holding in adjusted position the rapid acting platen of a compress, the means being adapted for arrangement relative to the said rapid acting platen in any position to which the same is adjusted.

MAGAZINE FOR TYPE-SETTING MACHINES.—J. J. HUMMEL, Spokane, Wash. This invention provides a magazine for holding type in position for delivery to a type setting machine having a feeding attachment adapted to mechanically deliver type pieces to the machine; provides for the said type graduated to the thickness of type being handled; provides for attaching the magazine to the font frame of a type setting machine; and provides a magazine to be rapidly and readily placed in position for refilling.

OPERATING KEYBOARD FOR TYPE SETTING MACHINES.—J. J. HUMMEL, Spokane, Wash. This invention provides a mechanism for rapidly operating the keys of a keyboard to arrest the carriers in their flight and in a manner to provide against conflict in selection of the type; provides a locking mechanism whereby the mentioned conflict is avoided; provides a mechanism arranged to produce a necessary interval of time between operations of the keys in harmony with the operation of the above mentioned rotary track mechanism supporting the type carriers.

FLYING MACHINE.—O. A. FENN, New York, N. Y. This invention is of the aeroplane type. An object is to provide a machine with a plurality of supporting planes, offset from one another out of vertical—alignment. Means provide for directing the vertical travel of the machine, and a universal rudder for further controlling the direction of travel of the machine. Supporting planes are provided capable of being distorted into parachute form.

POST MOLDING MACHINE.—A. W. SPOONER, Leonidas, Mich. The object here is to provide a machine for molding fence posts and the like, preferably of concrete, and adapted to mold posts of various shapes, depending entirely upon the form of mold used. The invention comprehends among its features, a self-dropping tamping plunger for suitably tamping the concrete in the mold and pressing it into a shape similar to the form of the mold.

COMBINED ELEVATING AND FRUIT CLEANING MACHINE.—A. J. NYE, St. Petersburg, Fla. An object of this inventor is to provide a device by which fruit such as oranges, grapefruit, lemons, etc., may be thoroughly cleaned from scale, dirt or other impurities while being elevated from a lower to a higher floor. The fruit is held positively in position while being cleaned by a series of spring actuated brushes which conform to the contour of the fruit.

VALVES.—J. J. MEYER, Yonkers, N. Y. The object of Mr. Meyer's invention is to provide a new and improved valve for use with high or low pressure water supply, and arranged to insure long life of the valve, to prolong the period of repairing or rewashering the valves, and to prevent waste of water by leakage.

TRIPLET BUCKET LADDER DREDGE.—M. S. GODIT, West Wareham, Mass. This invention pertains to a dredge of the endless bucket type, in which a plurality of individual bucket ladders are provided. An object is to provide a dredge with a plurality of ladders having endless bucket systems thereon, one of which operates in advance of the others in such manner that a more efficient operation of the device is obtained.

NUTCRACKING MACHINE.—B. W. ELDER, San Antonio, Texas. The invention refers more particularly to a machine which comprises a pair of movable members for actuating the same, and a cutter, the members having means for holding between them a nut, and serving to carry the same into engagement with and past the cutter to effect severing of the shell from the nut. Mr. Elder has invented another nut-cracking machine for cracking shells of different kinds of nuts, and it refers more particularly to a machine which comprises a pair of relatively movable cutter heads each having a cutter, and means for limiting the penetration of the cutters to prevent injury to the kernels of the nuts.

SOUND REPRODUCER AND RECORDER.—W. A. CHAPMAN, Smithville, Ark. The invention is particularly useful in connection with talking machines employing disk or other types of records upon which the sound waves are recorded in the form of grooves, and in which diaphragms are used to reproduce the sounds from the grooves, or to form the grooves upon blank records.

STRAIGHTENING MACHINE.—J. S. BACHMAN and C. E. MCLIN, Rome, Ga. The object of this invention is the provision of a machine for straightening previously used bale ties and for removing lint, jute or other extraneous matter from the straightened tie and which extraneous matter may adhere to the tie from previous use.

APPARATUS FOR BENDING PRINTERS' RULES.—J. A. RICHARDS, Albion, Mich. This invention is an improvement in hand-operated apparatus employed for bending printers' rules and other thin metal bars used for various other purposes, and it is particularly an improvement upon the apparatus forming the subject of Patent No. 707,744. When this machine is made of large size it may be successfully used for bending much thicker bars or rods used for various other purposes.

AUTOMATIC CLOTH MEASURING AND PRICE CALCULATING MACHINE.—R. H. SHEPPE, Big Stone Gap; H. H. EATON, Bristol, and C. D. ALLEN, Meadowview, Va. This device measures the number of yards of cloth sold, and at the same time calculates the total cost of the same. The invention provides a device in which any number of yards of cloth, within reasonable limits, can be automatically registered, and the price thereof simultaneously exposed to view, with means for automatically returning the device to its original position.

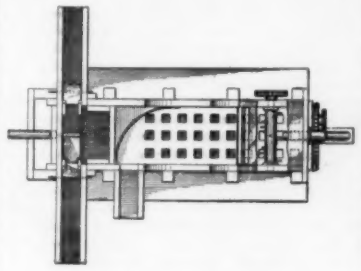
COMBINED STUMP PULLER AND STUMP PILER.—I. L. MITCHELL, Cedar Rapids, Iowa. Stump pullers of a certain type are provided with a rotary drum on which is wound a chain or rope that in practice is extended and attached to stumps to be extracted or removed. The inventor has made improvements in such pullers and has combined therewith an attachment for swinging the stumps laterally out of the way and collecting or piling them in heaps.

AERIAL VESSEL.—C. O. ROWLAND, Chicago, Ill. This improvement relates to aerial vessels, more particularly to that type known as "heavier-than-air" machines, and provides a vessel adapted to navigate in the air, various air currents in the atmosphere being employed to control and propel the vessel in addition to driving means provided on the vessel to more easily direct the same.

ADJUSTABLE SHOCK ABSORBING FOOT.—W. METZROTH, Middletown, Conn. This shock-absorbing foot is for use on typewriters, cash registers, or articles of furniture where it is desired to prevent the surface on which the article rests from being marred, and where it is further desired to take up the shock incident to the operating or moving of the article and deaden the sound thereon.

AERIAL NAVIGATION.—M. B. SELLERS, Baltimore, Md. The apparatus in this invention has four aeroplanes arranged in stepped form with the highest in front and each of the aeroplanes comprising two so-called wings alongside of each other with the wings of each aeroplane joined together by couplings at their meeting edges. The wings are supported and braced by struts; the frame is supported from the chassis, the latter comprising a combination of sled and wheels so arranged that when the aeroplane is acquiring initial velocity it will run on the wheels and in slighting the wheels rise out of the way, allowing the machine to come to rest on the runners.

WASHER FOR PEBBLE PHOSPHATE AND THE LIKE.—THOMAS ROBERTS, Charlotte Harbor, Fla. This washer separates pebble phosphate from sand, roots, etc., with which it is mixed, as generally obtained from the deposit at the bottom of water. It automatically removes and discharges roots and rids pebbles of sand, which it does by first cutting up the roots in order to facilitate their

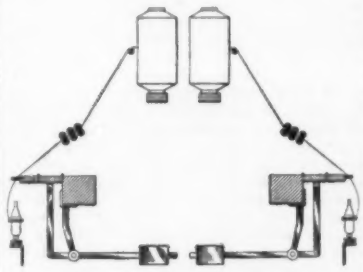


WASHER FOR PEBBLE PHOSPHATE.

expulsion over a grating. This grating admits of the passage of sand and pebbles through it to conveyers operating in a screened pocket adjacent to the screen on which they discharge. The screen in turn discharges on a second screen leading to the receiver for the pebbles, which is usually a barge. The washer is designed to be located on the upper deck of a dredge, and is shown herewith in a plan view.

SPINDLE LOCK.—M. OMALIA, Scranton, Pa. The more particular purpose here is to provide a lock for preventing the removal of a spindle, such, for instance, as is commonly employed in factory work, from its mounting, yet allowing the spindle all the freedom of motion which it now has, and also permitting the removal of the spindle when the operator sees proper to release the lock.

SELF BALANCED THREAD BOARD.—CHARLES E. WILLIAMS, Greenville, R. I. The accompanying engraving shows a view of self-balanced thread boards in position on their rails. The invention relates to ring spinning frames, and the object is to provide a board arranged to permit raising or lowering it conveniently by the doffer taking hold of the

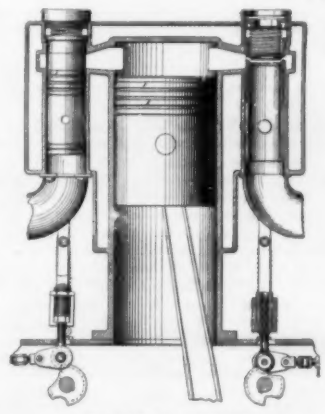


SELF-BALANCED THREAD BOARD.

board at any point in the length thereof, and swinging the board up or down, the board in any one of its positions being securely locked in place. For this result, use is made of a counterbalancing lever, a link connecting the lever with the board, and a locking device for holding the said lever locked in whatever position it is moved to, on the operator swinging the board into a desired position.

Prime Movers and Their Accessories.

ENGINE VALVE MECHANISM.—OSCAR TREIER, 3860 Tenth Avenue, Borough of Manhattan, New York, N. Y. The object of this invention is to provide a valve mechanism



ENGINE VALVE MECHANISM.

more especially designed for use in internal combustion engines, and arranged to insure proper opening and closing of the admission and exhaust valves, and to prevent leakage of the motive agent at the valves. For the purpose mentioned, use is made of a hollow valve for the passage of the motive agent (either live or exhaust), and the valve is adapted to engage a yieldingly mounted cap for closing or opening the hollow valve. In the accompanying engraving a clear presentation is given of the invention in a sectional side elevation of the valve mechanism as applied to internal combustion engines.

RADIATOR CAP.—C. P. ABS, Hoboken, N. J. This invention pertains to radiators, for cooling internal combustion engines. An object is to provide a cap which will condense and return to the radiator any water which may be vaporized by the heat in the radiator, and one which will return to the radiator any water which may be thrown through the vent into the cap.

POWER DEVICE.—T. A. MACDONALD, Clifton, N. J. An object of this inventor is to provide a device in which a maximum power is generated from a minimum expenditure of energy. A further object is to provide a wheel or a plurality of wheels, each consisting of a number of blades of particular shape, whereby the motive fluid which is designed to drive the blades is utilized to the fullest extent.

Railways and Their Accessories.

GUIDE BRACKET OR RAIL FOR EDGEWISE MOVABLE DOORS.—J. M. GRAY, Atlanta, Ga. It is sought in this invention to provide a construction whereby in case the door should become bound in position by the load within the freight car, or otherwise, it can be readily freed and opened; and to provide a construction which will be operative no matter in what position the car may be placed, in a wreck or otherwise, as it will operate with the car upside down.

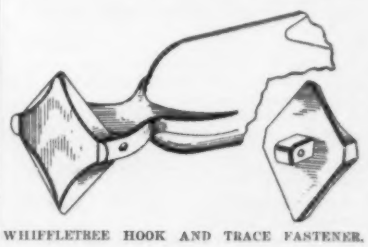
Pertaining to Recreation.

MECHANICAL TOBOGGAN SLIDE.—W. F. MANGELS, New York, N. Y. This invention refers to amusement apparatus, such as are used in pleasure resorts, parks, exhibition grounds, and other places, and its object is to provide a new and improved mechanical toboggan slide arranged to afford an exhilarating ride, and to provide means for racing, a number of toboggans or sleds starting simultaneously.

TOY.—C. G. PICKETT, North Berwick, Maine. This invention relates to toys, and more particularly to a toy consisting of a rotary member and a reservoir located over it, the reservoir being adapted to receive sand or other granular substances which, upon being released, operate the rotating member for the amusement of children.

Pertaining to Vehicles.

WHIFFLETREE HOOK AND TRACE FASTENER.—ALLEY ROOP, P. O. Box 601, Raymond, Wash. A trace fastener designed to replace the ordinary whiffletree hook is shown in the accompanying illustration. The attachment includes a ferrule which is secured on an end of the whiffletree, the outer end of the ferrule having a member adapted to be passed



WHIFFLETREE HOOK AND TRACE FASTENER.

through the eye of the trace, the base of the member being narrow and its outer end widened; the widened outer end has projecting side members that receive between them a detachable button, and between the side arms of the ferrule member there is formed also a recess which receives a stud on the inner side of the button. A removable fastening pin is passed through the stud of the button and the ferrule attachment to hold the trace in position.

BOTTOM DUMPING WAGON.—M. L. SENDERLING, Jersey City, N. J. A purpose here is to provide a vehicle for carrying materials in bulk, and which is adapted to dump from beneath and to provide a dumping scow bottom, since the bottom, which is in two hinged sections opening sidewise in opposite directions, not only constitutes a bottom for the body, but also has a carrying capacity of its own.

TIRE CONSTRUCTION.—C. N. HARRISON, Westfield, N. J. The more particular purpose of the inventor is to increase the life of the tire by giving the tire tread a desirable shape for the purpose of lessening the continual bending which the tread must ordinarily undergo. The invention further relates to clamping mechanism for holding edges of the tire far apart to give the intervening portion of the tire tread a substantially bow-shaped section.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12509) J. L. B. writes: You seem to have an idea of heat waves which is not the one accepted by physicists. See Maxwell's "Theory of Heat" (Longmans, Green & Co., 1904). On lower half of page 10 he defines three modes of heat transference. Then concerning one of these modes, on top page 237, he says: "Hence all that we have said about the waves of light is applicable to heat radiation, which is therefore a series of waves." Rearranging the sentence, we get that a series of heat waves is therefore heat radiation. Then see Preston, "Theory of Heat" (1904), page 56, top paragraph, where he states that all matter at any temperature gives waves of heat. Follow this with page 519 at bottom; "We shall confine our attention to the process of radiation, which does not appear to depend in any way on the presence of matter, but which takes place through the best vacua, and through interstellar spaces." This substantiates my original statement that a vacuum is no insulator for heat *waves*, i. e., *radiation*. Conduction and convection are eliminated as modes of heat transference by surrounding a body with a vacuum, and the radiation is made as small as possible by using a polished surface. See Preston, page 526, article 259, on the radiation of polished surfaces. In regard to the second part of my criticism, let me cite "Modern Electrical Theory," Campbell (Cambridge Series, 1907), page 106: "And the mean kinetic energy of the molecules in virtue of their *speed* of agitation is proportional to the temperature of the gas on the absolute scale." Also "Kinetic Theory," by Boyuton (Macmillan Company, 1904), page 42: "Two gases are at the same temperature when their molecules have the same mean kinetic energy." In neither case is any reference made to the number of collisions as having any *necessary* connection with the temperature. In Maxwell ("Theory of Heat"), page 32, we find the equation:

$$pv = 1/3\ \bar{v}^2$$

$\bar{v}$ = velocity
v = volume,
p = pressure.

And also the statement that pv and $1/2\ \bar{v}^2$ are proportional to absolute temperature. No form showing number of collisions of molecules is given. The number of collisions per second is given by an equation in Boynton, page 57:

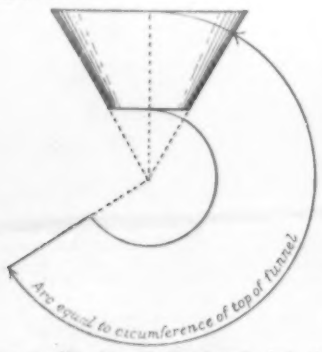
$$\frac{1}{T} = \frac{nsc}{V}$$

n = number of molecules per c. c.
$s = \sigma a^2$ in cross section of molecule.
c = velocity of molecule.
V = total volume considered.
T = time between collisions.

$\frac{1}{T}$ = number of collisions per second.

Notice that the velocity is only one of four factors that determine the number of collisions per second, so that the temperature of a gas and velocity of its molecules may be increased without increasing the number of collisions, provided the other factors (for example 21) be changed in the proper ratio. This substantiates my original statement that the number of collisions is not a *necessary* cause or result of a rise in temperature of a gas.

(12510) C. E. A. asks: Wishing to make a funnel from sheet iron, is there any way to lay it out, with say 6-inch top and 2-inch base? A. It is very easy to lay out a funnel, thus:



Draw a side view of the funnel, full size, produce the side lines to meet at a point, draw two circles from this point as a center and step off on either of the circles, with a pair of dividers set to a small space, a distance equal to the circumference of the funnel; then cut out the pattern.

NEW BOOKS, ETC.

THE ENGINEERING INDEX ANNUAL FOR 1910. New York: The Engineering Magazine, 1911. 8vo.; 496 pp. Price, $2.

The headings under which this admirable index is issued comprise civil engineering, electrical engineering, industrial economy, marine and naval engineering, mechanical engineering, mining and metallurgy, railway engineering, and street and electric railways. A specialist in any one of these branches will find a collation of references to the current literature of his subject. Two hundred and fifty publications are included, representing seventeen peoples and six languages. Every entry is accompanied by a short note defining the scope and purport of the article. This, the ninth volume, completes an index of engineering and technical literature covering twenty-six years, although the first two volumes, 1884 to 1895, are now out of print.

STORAGE BATTERIES. Their Theory, Construction, and Use. By A. E. Watson, E.E., Ph.D. Lynn, Mass.: Bubier Publishing Company, 1911. 16mo.; 166 pp.; illustrated. Price, $1.50.

In offering a second edition of "Storage Batteries" the author endeavors to give within limited space all the essential features and advantages of the modern makes of cells. He sets forth in simple language the theory of the chemical actions involved, gives his own method of making plates, tells how to set up and care for batteries, and instructs the reader as to switch-board arrangements. The lead type of cell is dealt with almost exclusively, as being the only really efficient cell on the market. The descriptions of cells have been approved by their manufacturers, so that the accuracy of each description is assured.

TO MARS *via* THE MOON. By Mark Wicks. Philadelphia: J. B. Lippincott Company, 1911. 8vo.; 328 pp.; illustrated. Price, $1.50.

The world is beginning to see that there is more romance in science and more science in romance than it has heretofore been willing to admit. Perhaps this fact is sufficient excuse for Mr. Wicks's attempt to take us to Mars in a flying-machine. At any rate his pleasing narrative is a medium for the conveyance of the latest discoveries and speculations concerning Mars and its mysteries, and he is to be commended for the care with which he has drawn the line between fact and fiction while sustaining at the same time the interest of both. Mr. Wicks has put himself to the trouble of constructing a number of globes reproducing the appearances of Mars at different seasons and in varying phases; the plates showing these globes make it easy to follow his description, theories, and arguments. Most people have extremely hazy ideas regarding the relative motions of the earth and the planets, the probable appearance of interstellar space, and the possibility of the existence of life on other worlds than our own. For this majority, sugar-coated science is not without its beneficial qualities, and such a narrative as "To Mars *via* the Moon" will help them to a better understanding of our solar system and its marvelous machinery.

BEN STONE AT OAKDALE. By Morgan Scott. New York: Hurst & Co., 1911. 8vo.; 316 pp.; illustrated. Price, 60 cents.

Boys demand incident and action in their fiction. If the story glorifies some boy hero, so much the better. There is plenty of boy and plenty of action in "Ben Stone at Oakdale." Ben, the hero, is the proverbial dog with a bad name. His plucky stand against adverse circumstances and persecution forms the substance of the narrative. While adventures are encountered and prodigies performed, the probabilities have not been strained to the vanishing point, the characterization is kept within the bounds of reason, and inspiration toward fair play and manliness breathes from every page.

THE EXPERT SIGN PAINTER. By A. Ashmun Kelly. Malvern, Pa.: A. Ashmun Kelly, 1910. 8vo.; 302 pp.

As its title implies, this is a book of reference for practical sign painters and letterers. It is not a collection of lay-outs and alphabets, but places before the expert workman the varying methods of other expert workmen compiled not alone from the writer's own experience, but from all the published works and current literature on the subject with which he has been able to get in touch. In the historical sketch which introduces the subject, the writer makes mention of such well-known men as Benedict Arnold and James Whitcomb Riley. Arnold wielded the brush and pencil on sign-work while living in New Haven, and Riley began life as a sign-painter. From a general consideration of letters and lettering, we pass to the tools of the trade, the pigments, and the construction of the sign-board. Special requirements are treated in separate chapters, as the things necessary to be observed in church lettering, in wall signs, in lettering on oil cloth and canvas, in silk and satin banner painting, and in smalts and smalting. Work on glass—gilding, pearl leaf enrichment, embossing, and imitation frosting—is given several chapters. Even the prices charged for various kinds of work are given, the office equipment and stationery are taken under advisement, and side-occupations such as glass-drilling, the manufacture of bronze powder and tinfoil, and the silvering of mirrors are dealt with in the concluding chapters of the work.

SOME SMALL HOUSES. By Walter Gray Ross. New York: Frederick Warne & Co. 8vo.; 94 pp. Price, $1 net.

"Some Small Houses" was first issued in 1908. That edition having been exhausted, the opportunity has been taken to enlarge the work. There are ninety reproductions of photographs and black-and-white drawings, besides a frontispiece in color, and many of these cannot fail to interest that great proportion of educated people who, as the author truly says, have to make their homes in small houses. It is an English publication, hence the cost estimates given will not apply to this country. Aside from this drawback, however, there is no reason why the designs should not be at least helpfully suggestive to American home-builders, if not to be adopted in their entirety.

COMMERCIAL GEOGRAPHY. By Edward Van Dyke Robinson. Chicago: Rand, McNally & Co. 12mo.; 455 + 48 pp. Price, $1.25 net.

The last decade has seen the publication of a number of commercial geographies which all have more or less merit. The present volume, however, departs rather radically from its predecessors, and being published by a large map and atlas house, the maps themselves are of the highest order. It is impossible to see how a more complete and useful book on this subject could possibly be written. The beautifully colored maps are not placed at the end of the volume or scattered through the book as inserts, but are actually printed where they belong with the text. The illustrations are numerous and are in the main well executed. The author has performed his task in a thoroughly scholarly manner, and has produced a book which should be in the library of all persons who are interested in progress, whether they care for a commercial geography or not. The possession of this book will widen the mind of any one. Few people, for instance, could tell you much about the Canal Zone. Here we find a map showing the boundary lines, the position of the great Gatun locks, Panama, Panama Harbor, the Culebra Cut, etc. The treatment is of course regionary. We can recommend this book as being a valuable addition to the library.

THE NEW DICTIONARY OF STATISTICS. A Complement of the Fourth Edition of Mulhall's "Dictionary of Statistics," by Augustus D. Webb, B.S.C., F.F.S. London: George Routledge & Sons, Ltd. New York: E. P. Dutton & Co. Quarto; 682 pp. Price, $7.

"Mulhall" is the great authority which is constantly cited by all statisticians. Unfortunately, however, it is out of date, so that the present volume will be warmly welcomed as a complementary volume. In our own experience we have found that the book on statistics is out of date in certain particulars before the first copy leaves the bindery. "Figures," according to the oft-quoted dictum, "can prove anything." As a matter of fact, they prove nothing. It is the human mind that proves (or attempts to prove) things, and things are but evidences to be examined, weighed, and judged as any other kind of evidence. To this end no explanatory matter, either in the way of foot notes or of text that may accompany the figures, should be left unread or ignored. This advice from the preface is specially good advice. The author wisely notes that the comparison of international statistics is notoriously difficult. The expense of producing a book of this kind is so great that it is to be hoped that it will have a considerable sale. The book is very well made.

MODERN METHODS OF WATER PURIFICATION. By John Don, F.I.C., A.M.I., and John Chisholm, A.M.I. New York: Longmans, Green & Co., 1911. 8vo.; 368 pp.; 96 illustrations. Price, $4.20 net.

This is a review of the different processes of water purification, with a consideration of the extent to which they are justified by results. Much of the existing literature of this subject is in periodical form and in scattered Health Board reports. "Modern Methods of Water Purification" brings together the gist of these scattered papers and presents it in a readily accessible and permanent form. The sources of supply are considered in connection with the means used for the detection of pollution. Storage and the chemical changes it effects are dealt with in a succeeding chapter, and the copper sulphate treatment of plant growths is explained. The chapter on the construction of reservoirs is illustrated by diagrams showing basins in this country and in England. Sand filtration and the management of sand filters is given space equal to almost a fourth of the entire volume. Mechanical filters, the ozone process, water-softening and household appliances, the testing of water, and the problems of distribution are treated in the latter part of the work, which concludes with filtration constants and data, tables, and a short bibliography. Water purification is a subject of growing interest and great importance. The work in hand is timely and comprehensive.

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The New Era of Blood-transfusion

(Continued from page 123.)

fastened into that one of the two grooves on the ring which happens to be nearest to the handle. (See Crile method.) The artery is then drawn *over* the vein so its inner surface touches the cuff, and is fastened into the remaining groove. The lining of the two blood-vessels thus meet as in the Carrel suture.

Crile experimented upon hundreds of dogs before operating upon a single human being, and has been roundly abused for his pains by the anti-vivisectionists. There being obvious danger to the giver from anæmia, and danger also that the heart of the patient might be filled so full that it could no longer pump, Crile wanted to know just how much blood might be lost and received.

The heart requires a certain volume of fluid (blood) in the vessels in order to have enough to pump on. So, in severe hemorrhage, temporary relief is given by filling up the vessels with salt water (saline-solution, infusion, as it is called). The salt water cannot replace the blood, but it gives the heart something with which to pump, and so tides the body over the emergency. After a time, the salt-water leaves the body through the kidneys, and the patient is as badly off as before. This is not the case with transfused blood; that stays in the vessels.

There is another condition known as "shock," in which although the blood stays in the vessels, the heart has just as much difficulty to pump as though there had been a bad hemorrhage. The reason is because in shock, the injury to the nervous system causes a paralysis of the nerves known as vasomotor. The result of this paralysis is that the blood-pressure disappears just as though a severe hemorrhage had removed the blood, and Crile has shown that, also for this condition, transfusion is the best remedy we have.

A man may be so injured by machinery as to require an immediate operation, but he has lost so much blood that his remaining strength may give way; transfusion rectifies the condition by supplying a sufficient quanti y of red blood-cells to combine with the oxygen of the air and give back the oygen to the tissues. Crile says that recovery from hemorrhage is largely a problem in mechanics, as andrenalin has been added to the circulation even after death, and the heart action substituted by manual pressure—and blood-pressure thus made to rise. We all know when a man is poisoned by gas that the red coloring matter (three hundred times as greedy of carbon-monoxide as of oxygen) has been displaced. Thus the blood is destroyed, and new blood, through transfusion, furnishes a certain corrective, if not delayed too long.

Research on the Blood.

Denys in the 17th century advocated the use of animal blood in transfusion; maintaining that as the animal lives more closely to a state or nature, his blood must be purer than man's; and answered arguments against it by inquiring why the meat we eat and the milk we drink does not act deleteriously. In view of modern blood-tests, his attitude is instructive as showing what plausible fallacies may be advanced if reasoning, as such, be not corrected by experience.

In 1821, Dumas and Provost gave out the results of their studies on the chemical properties of the blood; showing that when the bloods of different species were mixed, even though the globules were of the same size but of different dimensions, animals rarely lived longer than six days. The blood of an animal with circular corpuscles injected into a bird caused the death of the bird with symptoms of violent poisoning.

In 1875, Landois showed precisely what takes place when the blood is thus mixed. The red corpuscles are dissolved by the poisoning of the protoplasm, and the hemoglobin (coloring matter) exuded from the envelope. Under the microscope, the first stage of this condition (hemolysis) shows the corpuscles beginning to swell. The injection of certain chemicals causes the same phenomenon, and hemolysis occurs on artificial heating or freezing of blood. The consequence is the breaking down of the cell-[illegible] This objective demonstration, as might have been expected, put a stop to the use of animal blood in transfusion.

Modern transfusion shows that while the blood of one healthy person does not poison the blood of another healthy person, the blood may acquire such power through certain diseases, since the disease may act in such manner as to change it. In this case, too, there is a dissolving of the cells by blood which, though apparently normal, in reality is not. If the sick man's blood has this property of dissolving (hemolyzing) the blood-cells of the giver, the new blood will do him no good, as it will be destroyed as rapidly as it is transfused. If by an oversight the blood of the giver has this property, the transfusion will be even more dangerous, as the new blood will destroy that already present in the patient's vessels. By testing the two bloods against each other this danger may be avoided.

Another peculiar property of the blood is what is called agglutination, known only since 1900. When the bloods of two different persons are mixed, they often have the effect of making the blood-cells clump together in tight little masses. Landsteiner showed that all human beings fall into four sharply defined classes in this regard, and that agglutination may be explained by assuming the existence of two agglutinins, of which the second group possesses one, the third group the other, the first group both, and the fourth neither. When the blood of persons belonging to any one class is mixed with the blood of a person belonging to any of the other three classes, agglutination occurs; but this is avoided if the blood-test shows that the giver and receiver of the blood belong to the same class. This is a hereditary quality, and an examination of seventy-two families shows that the agglutinins follow Mendel's law.

It is evident that if blood were transfused from a person belonging to one of the classes referred to, into the vessels of a person belonging to any one of the other three classes, the clumps likely to form would cause a stopping up of the blood-vessels, and thus serious trouble indeed. Ottenberg is investigating further the phenomenon of agglutination at Columbia College and Mt. Sinai Hospital at the present time. Medical opinion is that performing the agglutination-test for transfusion may, in many cases, make all the difference between a transfusion that is successful and one that means merely a waste of human blood.

Formerly, the patient often became worse after the operation; indiscriminately taking blood from anyone willing to give it was a contributing cause. Now when members of the family are rejected, for the reasons outlined, advertisements are put in the newspapers; fifteen to twenty respondents, at that, often being rejected as unfit to serve, and the one selected whose blood has the least, or no toxic action. The person who gives his blood must be strong enough to lose it, and he must have no blood-disease; by which it would appear that even selling one's blood is not by any means as easy as might be supposed.

The Current Supplement

THE mounting and grouping of exhibition specimens as practised at our National Museum of Natural History, has developed into a fine art. A particularly striking group of fossil remains of the great ground-sloth has just been completed, and in the current SUPPLEMENT, No. 1857, Mr. Beasley tells us about these giants of the past, and the good work accomplished in setting up in realistic arrangement these representatives of an age long gone by.—In questions relating to social conditions it is unfortunately very difficult to arrive at thoroughly objective conclusions, independent of subjective bias, and therefore accepted by all who devote serious thought to the subject. An attempt to apply objective methods of scientific experiment to questions of labor and wages is reported on in a very interesting article by D. A. Imbert.—That the time of day varies from place to place on our globe is a fact known to every schoolboy. But with all the details of the circumstances, which determine the "true solar day," probably not very many of us are acquainted. An article contrib-

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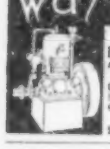

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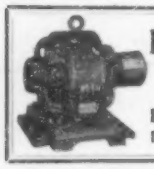

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uted by Professor F. R. Honey, of Trinity College, elucidates these points.—Lieut.-Col. Hubner writes on "Combination Projectiles," a field in which recent years have brought developments exceeding some of the earlier expectations.—"There is to-day a growing tendency," says Mr. S. S. Hough in his article on "Photography an Aid to Astronomy," "to replace the human eye at the end of the telescope by the photographic camera." The advantages thus gained, and the historical development of astro-photography are set forth by the author.—A new portable gasoline air-compressor suitable for inflating pneumatic tires is described by Mr. F. C. Perkins.—In an article originally published in the *Umschau*, Professor Zuntz gives an account of a new respiration calorimeter used at the Agricultural School at Berlin for investigations in the physiology of nutrition and animal work.—There is also an article by J. W. T. Duval on a moisture tester for grain and other substances.—The second and concluding instalment of the paper by W. H. Dines on "Practical Applications of Meteorology to Aeronautics" appears in this issue, as does also the second instalment of Donald Murray's article on "Printing Telegraphy."

The Split-log Drag in Road-making

THE public roads bureau of the Department of Agriculture has estimated that there are 2,000,000 miles of earth roads in the United States and has suggested an inexpensive way for their improvement. The split log drag is its solution of the problem, and from time to time the bureau issues bulletins informing the farmer how to make it.

The main thing needed is a dry red cedar log, although red elm and walnut are useful for the purpose, while box elder, soft maple, or even willow may be employed. Oak, hickory and ash are not recommended.

The log, seven to ten feet long and ten to twelve inches in diameter at the butt, is split as near the center as possible, the larger piece being used as the front of the drag and sometimes being shod with iron along the lower or cutting edge.

The two slabs on edge and thirty inches apart are fastened together by stakes in such a way that when the drag is in use on one side of a road, the end of the back slab is about sixteen inches nearer the center of the drive-way than the end of the front slab. This gives what is called the setback. Between the heavy slabs and resting on the connecting stakes is a board on which the driver stands.

A team of horses is hitched to this completed drag in such a way that the drag unloaded will follow at an angle of about forty-five degrees. The teams should be driven with one horse on either side of the right hand wheel track or rut the full length of the part to be dragged, and made to return in the same manner over the other half of the road-way. Such treatment will move the earth toward the center of the roadway and raise it gradually above the surrounding level.

There is recommended the use of the split log drag after heavy rains, when the road should be gone over once each way, but much depends on the quality of the soil, some roads requiring frequent treatment.

The method is said to be most economical.

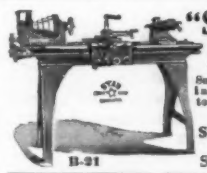
A Peculiar Well.—The attention of the Geological Survey having some time ago been called to a peculiar well in Ohio, an investigation thereof was made. The well produces both fresh and salt water through two separate pumps. The explanation proved to be quite simple. Two water-bearing beds, confined between layers of limestone, occur at this point, one above the water. The pipe of the fresh-water pump taps the upper vein at a depth of sixteen feet. The pipe of the salt-water pump touches the lower vein at a depth of thirty-five feet; and the brine, being heavier than the fresh water, does not mix with it, but remains at the bottom.

Aeronautics

The European Circuit Race.—The 1,074-mile Paris-London-Paris Circuit race, which started so disastrously, on June 18th, was finally ended on July 7th. Nine aviators out of the 41 who started succeeded in finishing. The race was won by Lieut. Conneau in his Blériot monoplane, his time being 58 hours and 38 minutes. His actual flying time was 24 hours, which corresponds to an average speed of nearly 45 miles an hour. Roland Garros was second in his Blériot monoplane with the time of 62 hours, 17 minutes, 16 2/5 seconds. Vidart, in his Deperdussin monoplane, was third, in 73 hours, 32 minutes, 57 3/5 seconds. Vedrines, in his Morane monoplane, came fourth in 86 hours, 37 minutes, 2 seconds. Gibert, on an R. E. P. monoplane, finished fifth, and Kimmerling, on a Sommer monoplane, sixth. Their times, respectively, were 89:42:34 3/5 and 93:10:24 2/5. Maurice Farman biplanes, driven by Renaux and Barra, were seventh and eighth, respectively, their times being 110:14:05 2/5 and 206:21:58. The former aviator was the only one who finished the entire race carrying a passenger. Tabuteau, with a Bristol (English) biplane, was the ninth and last to finish. Valentine, an Englishman, flew his Deperdussin monoplane as far as London, but abandoned the race at that point. This race was the greatest test of endurance that has ever been given the modern aeroplane. Flights were made in wind, rain, and fog. The greatest elimination occurred in the first stage, in which 23 machines dropped out. The second, third fourth, and fifth stages saw the dropping out of one, three, two, and two machines, respectively, while ten completed the seventh stage and arrived at London. Some of the stages were flown at a speed of over 60 miles an hour.

A Flight Across New York City.—On July 8th, Ladis Lewkowitz, a Russian aviator who had previously maue a 6,000-foot altitude flight at Nassau Boulevard Aerodrome with his Blériot monoplane fitted with a 50-horse-power Anzani motor, ascended at that place and flew to New York. He came above the East River at the Queensborough Bridge and flew up the River to Harlem at a great height. When crossing over the city at an altitude of between 8,000 and 9,000 feet, his motor stopped and the aviator was obliged to *vol plane*. This he did with such good results that he crossed the Hudson River and landed in a marsh back of Leonia, some six miles away from where the motor gave out. His flight and that of Atwood are the only two flights which have been made above New York since the Statue of Liberty race last October.

A Record American Cross-Country Flight.—A flight somewhat in line with the great long distance races recently held abroad was made the first part of last month by Harry N. Atwood, the young Boston aviator. After having made numerous cross-country trips in the vicinity of the Hub, Atwood flew with his mechanic from Boston to New London, Conn.—a distance of 110 miles—in 2 hours and 10 minutes on June 30th. The trip was made without a stop and in the afternoon the young aviator took aloft the mayor of New London and flew above the Yale-Harvard Varsity boat race. At 7 o'clock the next morning, he started for New York, which city he reached in about 3¼ hours without a stop *en route*. After alighting and refilling his fuel tank at Astoria, he flew down the East River and across the sky scraper section of Manhattan Island, finally alighting with precision upon Governor's Island. On July 4th he flew the 110 miles to Atlantic City in 5¾ hours, which included several stops for gasoline. He was buffeted by extremely strong head winds all the way. His machine fell in the sea and was demolished when he and Charles K. Hamilton were making an exhibition flight together at Atlantic City, but he persuaded Hamilton to loan him the latter's Burgess-Wright biplane for the balance of the flight. Hamilton had his aeroplane towed over the road from Waterbury, Conn., to Atlantic City, which was accomplished in about a day, and the next morning he and Atwood resumed their



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journey toward Washington. On account of the great humidity they found extreme difficulty in rising more than 150 feet and they were finally obliged to alight near Baltimore because of their inability to clear trees and buildings. The following day (July 11th) Atwood and Hamilton covered the 40 miles remaining between Stemmer's Run and College Park in the early morning hours without mishap. Taree days later he finished his 576-mile trip to Washington and alighted on the lawn of the White House, where he was greeted by President Taft. In all he took two weeks in which to cover the distance, whereas in the recent circuit race in England, twice this distance was covered in but 31½ hours elapsed time by Lieut. Conneau in his Blériot monoplane

Science

Cranes and Herons in Surgery.—Many substances have been employed in turn for making sutures in surgery. Such substances must possess peculiar properties, which are not readily found. Of recent years there has been recommended and used a new material of this kind, the tendons of the legs of cranes and herons. The tests show that these tendons are particularly well suited for surgical use. They are said to form excellent ligatures, and are readily absorbed after the wound has healed.

The Exploration of Dutch Guiana.—The expedition that set out from Paramaribo in July, 1910, to explore the only part of Dutch Guiana not previously known to the civilized world—viz., the upper Corentyn and its tributaries—after suffering the loss of its leader, Eilert de Haan, achieved the object of its labors most successfully under Lieut. Kayser. This expedition was the last of a series that have been working for the past 15 years, under the auspices of the Geographical Society of the Netherlands, in making a complete exploration of the colony.

Color Photographs of Atmospheric Phenomena.—The improvements and simplifications lately introduced by Messrs. Lumière in the process of color photography were the subject of a recent address by M. Léon Gimpel before the Astronomical Society of France. The method of development has been greatly facilitated by the use of a green light, obtained by applying "Virida" paper to the lantern; while magnesium light is used in printing, and an unlimited number of prints may now be easily produced. Instantaneous pictures are readily taken with plates made hypersensitive, according to the method of Simmen and Thovert. M. Gimpel has applied these various improved methods with great success to the photography of meteorological phenomena — thunderstorms, rainbows, fogs, inundations, auroras, sunsets, etc.—and in the course of his lecture he threw on a screen a number of beautiful pictures of this character.

Aerological Observations in Java.—Dr. W. van Bemmelen has published in the *Meteorologische Zeitschrift* a report on the *ballon-sonde* observations made near Batavia during the year 1910. They are the most extensive series of such observations heretofore made within the tropics, and the results are in satisfactory agreement with those obtained by Berson, in German East Africa, in 1908. The stratosphere was reached several times, at altitudes ranging from 15 to 18 kilometers, and with temperatures ranging from —67 deg. C. to —83.5 deg. C., the latter being the lowest temperature recorded, and, with the exception of Berson's reading of —83.9 deg. C., the lowest ever observed in the atmosphere. Such readings are, however, uncertain to the extent of some degrees at the great altitudes in question. The average thickness of the westerly monsoon wind was found to be 5.5 kilometers. Many difficulties in the technique of the observations were only partially overcome, but there is every reason to hope that the excellent work in aerology now being carried on by the Dutch observers in Java will in a few years fill the serious gap that has heretofore existed in our knowledge of the upper air, due to the neglect of this class of investigations within the tropics.

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CONSERVATION

The AUGUST Magazine Number of the SCIENTIFIC AMERICAN Issue of AUGUST 12th, 1911

The next magazine number of the Scientific American, August 12th, 1911, will contain a series of articles by leading authorities, which will deal with this vital subject of the conservation of our natural resources.

Ex-Chief Forester the Hon. Gifford Pinchot, whose earnest fight for the preservation of the coal lands of Alaska has led to a favorable decision of the Land Office, which greatly strengthened the cause of conservation, will open the number with an article on the Conservation of our Forests.

The Director and Chief Engineer of the Reclamation Service, F. H. Newell, will write a general article on the past work and future plans of the Reclamation Service.

The Director of the Bureau of Mines, Dr. Joseph A. Holmes, will show that the waste of our supplies of coal is due not merely to careless and extravagant management in the mining of the coal, but also and very largely to methods in burning the fuel.

Dr. David T. Day, of the United States Geological Survey, will prove, in an article on the conservation of oil and gas, that, as with coal, so with oil and gas, it is possible to effect large economies by judicious management in the oil and natural gas fields and by the use of improved appliances in burning these fuels either for light or power purposes.

Dr. Hugh M. Smith, Deputy Commissioner of Fisheries, will contribute an article on the Conservation of Fish, Oysters, etc., and Seals. Conservation is a word to which we are liable to give too restricted an application.

In addition to the above articles, the August 12th number will contain the usual Editorial, Aviation, and other departments.